

BARBUS (PISCES, CYPRINIDAE) OF THE
VOLTA REGION



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SYNOPSIS

Eighteen species of *Barbus*, collected recently in Ghana, are described and figured. Fifteen of the species were obtained from the Volta basin. The synonymy of West African *Beirabarus* is revised and four species of this subgenus are shown to occur in Ghana. *Barbus nigeriensis* is redescribed using the holotype augmented with new material. A key is given for voltaic species of *Barbus*.

INTRODUCTION

Barbus is one of the most specifically numerous genera of freshwater fish in Africa and well over 200 species have been described. The genus is well represented in West Africa and fifteen species were identified from a collection of fish which we made in the Volta basin, chiefly in northern Ghana, during 1961. Most of the species are widespread and common and *Barbus* forms an important and characteristic element in the fish fauna of all habitats. The present investigations deal chiefly with voltaic

species but observations are also made on three species of *Barbus* collected from the Prah basin in the forest region of southern Ghana :

- B. ablables* (Bleeker)
- B. trispilus* (Bleeker)
- B. subinensis* Hopson

Environmental conditions in the rivers of northern Ghana are comparable with those described by Blanc & Daget (1957) for Haute Volta and by Holden (1963) for the Sokoto River in Northern Nigeria which are indeed typical of the whole savannah region of West Africa. Flooding occurs during a short rainy season lasting from mid-May to mid-September followed by a rapid fall in water level with the onset of the dry season. By the end of December the output of the Black Volta in northern Ghana is greatly diminished and the White Volta is reduced to a mere trickle linking a chain of sandy pools. Smaller tributaries dry out completely before the onset of the rains in May. A more stable environment is found in permanent, well-vegetated oxbow lakes which are particularly characteristic of the valley of the White Volta. Relatively stable conditions are also found in dams constructed across seasonal streams for agricultural purposes ; these are now common in Ghana.

Previous observations on *Barbus* in Ghana have dealt almost exclusively with species occurring outside the Volta basin (Boulenger, 1911, 1916 ; Trewavas in Irvine, 1947). A detailed account of voltaic species was made only during the last decade by Blanc & Daget (*op. cit.*) who worked on material from Haute Volta. They recorded nine species of *Barbus* from the Volta basin :

- B. macrops* Blgr. (= *B. ablables*, *sensu* Blanc & Daget, 1957)
- B. parablables* Blanc & Daget
- B. voltae* Hopson (= *B. nigeriensis*, *sensu* Blanc & Daget, *op. cit.*)
- B. macinensis* Daget
- B. punctitaeniatus* Daget
- B. atakorensis* Blanc & Daget
- B. leonensis* Blgr.
- B. stigmatopygus* Blgr.

Most of these are widely distributed elsewhere in the savannah region of West Africa and all, with the exception of *B. parablables* and *B. atakorensis*, were shown by Blanc & Daget to be common to the Niger basin.

Six additional species were recorded from the Volta basin during the present survey :

- B. spurrelli* Blgr.
- B. hypsolepis* Daget
- B. nigeriensis* Blgr.
- B. lawrae* Hopson
- B. bawkuensis* Hopson
- B. pobeguini* Pellegrin

Of these, *B. hypsolepis*, *B. nigeriensis* and *B. pobeguini* also occur in the Niger basin.

In the course of the present investigations extensive use has been made of material

in the British Museum (N.H.) and in the Musée National d'Histoire naturelle, Paris. Comparisons were made with type material whenever possible. Most of our observations agree with Daget (1954) and Blanc & Daget (1957). We differ mainly in the synonymy of the subgenus *Beirabarus* and in the diagnosis of *B. nigeriensis*.

Four species of *Beirabarus* are shown to occur in Ghana: *B. ablakes*, *B. spurrelli*, *B. macrops* and *B. parablakes*. *Barbus deserti* of Daget (1954) and *B. ablakes* of Blanc & Daget (1957) are now regarded as misidentified examples of *B. macrops*, which proves to be widely distributed through the savannah regions of West Africa and the Chad basin. *Barbus ablakes* and *B. deserti*, with which *B. macrops* has been confused, are apparently restricted in distribution, *B. ablakes* to the forest rivers between south west Ghana and Liberia and *B. deserti* to the north central Sahara.

A redescription has been prepared for *B. nigeriensis*, based on the holotype, on material from Western Nigeria and on specimens recently collected in northern Ghana. The species described by Blanc & Daget (1957) as *B. nigeriensis* was misidentified. It has been shown recently to be a new species, *B. voltae* (Hopson, 1965).

Methods: the snout length was measured between the verticals to the tip and the anterior margin of the eye; the head length was taken to the posterior extremity of the bony operculum. Ledges of skin forming the dorsal margin of each orbit are included in the interorbital width. Perforated scales overlapping the base of the caudal fin are included in the lateral line count. Other data were obtained in accordance with standard practice.

All specimens were fixed initially in 5% formalin for three to four months. The material was then carefully washed and transferred to an 80% solution of alcohol for permanent preservation. It was found that this procedure satisfactorily exposes the underlying melanophores, the pattern of which is often of taxonomic importance.

The relationship of lateral line to horizontal myoseptum often provided characters of diagnostic value. Marked differences were noted among the *Barbus* under consideration in the degree to which the lateral line dipped below the myoseptum. In species of the subgenus *Beirabarus* and in *B. punctitaeniatus* for example the dip is slight whereas in *B. nigeriensis* and *B. lawrae* it is more pronounced. The maximum distance between horizontal myoseptum and lateral line has been expressed in terms of the depth of adjacent scale rows. The point at which the myoseptum and lateral line converge also varies interspecifically. In *Beirabarus* the point is usually above the base of the anal fin whereas in *B. perince* and in *B. wernerii* they converge near the tip of the caudal peduncle.

CEPHALIC PIT-LINES

Herre (1932) first drew attention to cephalic pit-lines in *Barbus palustris* (= *B. radiatus*, vide Greenwood, 1963) and considered them to be of sufficient importance to be the criterion for establishing a new genus, *Beirabarus*. Apparently unaware of Herre's work, Schultz (1942) described a new genus *Mannicthys* (*M. lucileae* Schultz = *B. macrops* Boulenger), on an identical basis. Johnels (1954) later showed that cephalic pit-lines were present in at least six West African *Barbus* and doubted

the advisability of using them as generic or subgeneric characters. Recently, Greenwood (1962) has given a detailed discussion on the occurrence of pit-lines in African *Barbus*. He upholds Herre's taxon *Beirabarb* at subgeneric level and recognizes two distinct patterns of pit-line distribution.

(a) Pit-lines of the *Beirabarb* type where the individual pits are small and very numerous, grouped tightly into lines like beads and raised above the surface as ridges. These lines sometimes branch and are present in a characteristic pattern on the side of the snout, the cheek, the operculum and on the dorsal surface of the head. On the basis of these characters, Greenwood referred the following species to the subgenus *Beirabarb* :

<i>B. abl</i>	<i>B. deserti</i> Pellegrin
<i>B. radiatus</i> Peters	<i>B. aurantiacus</i> Blgr.
<i>B. jae</i> Blgr.	<i>B. macrops</i> Blgr.
<i>B. aspilus</i> Blgr.	<i>B. spurrelli</i> Blgr.
<i>B. callipterus</i> Blgr.	

(b) The pits are relatively larger than in *Beirabarb* and much fewer in number. They are sometimes arranged in lines but with the pits always well separated from one another. The lines are never raised above the surface in ridges and are usually visible only on the cheek and operculum. Greenwood found this type of pit in fourteen species of *Barbus* :

<i>B. nigeriensis</i> Blgr.	<i>B. trispilomimus</i> Blgr.
<i>B. kessleri</i> (Steindachner)	<i>B. pumilus</i> Blgr.
<i>B. trispilus</i> (Bleeker)	<i>B. anema</i> Blgr.
<i>B. congicus</i> Blgr.	<i>B. svenssoni</i> Johnels
<i>B. pseudognathodon</i> Blgr.	<i>B. collarti</i> Poll
<i>B. pleuropholis</i> Blgr.	<i>B. leonensis</i> Blgr.
<i>B. urostigma</i> Blgr.	<i>B. cercops</i> Whitehead

Of the above species, only *B. kessleri* has a serrated last simple dorsal ray and all with the exception of *B. cercops* are West African in distribution.

Our own observations agree with Greenwood's. Cephalic pit-lines were noted in all of the eighteen species of *Barbus* described in the present work. Of these, four are referable to *Beirabarb* :

<i>B. abl</i>
<i>B. spurrelli</i>
<i>B. macrops</i>
<i>B. parabl</i> Blanc & Daget

The remaining fourteen species all had weakly developed pit-lines corresponding to the description under (b) above. They are as follows :

<i>B. hypsolepis</i> Daget	<i>B. voltae</i> Hopson
<i>B. nigeriensis</i> Blgr.	<i>B. atakorensis</i> Blanc & Daget
<i>B. lawrae</i> Hopson	<i>B. punctitaeniatus</i> Daget

<i>B. subinensis</i> Hopson	<i>B. bawkuensis</i> Hopson
<i>B. trispilus</i> (Bleeker)	<i>B. pobeguini</i> Pellegrin
<i>B. sublineatus</i> Daget	<i>B. stigmatopygus</i> Blgr.
<i>B. macinensis</i> Daget	<i>B. leonensis</i> Blgr.

Cephalic pit-lines were always most clearly seen in formalin-fixed specimens.

***Barbus (Beirabarus) ablabes* (Bleeker, 1863)**

(Text-fig. 1)

Puntius (Barbodes) ablabes Bleeker, 1863, *Nat. Verh. Wet. Haarlem*, **23** : 114, pl. 23, fig. 1.

Barbus ablabes : Boulenger, 1911, *Cat. Afr. Fish.* **2** : 156, fig. 133.

Barbus ablabes : Pellegrin, 1923, *Les poissons des eaux douces de l'Afrique occidentale* : 134, Paris.

[*non Barbus ablabes* : Blanc & Daget, 1957, *Mem. Inst. France. Afr. Noire*, no. 50 : 132, fig. 13, see p. 110 below].

SYNTYPES : two fish S.L. 64 and 66 mm. from Dabo Crom, Guinea in the Leyden Museum.

DESCRIPTION based on 30 fish, 31–53 mm. S.L. from the R. Weiwei, Kumasi, south Ghana supplemented with notes on the following material in the British Museum (N.H.) : 10 fish, 44–70 mm. S.L. from the Kotchwah River, south Ghana (reg. no. 99.12.22.46–55) ; 4 fish, 36–48 mm. S.L. from the R. Atesu, south Ghana (reg. no. 1903.4.24.94–97) ; 2 fish, 58–62 mm. S.L. from near Bunsu, south Ghana (reg. no. 1938.12.15.40–41).

Body moderately compressed. S.L. 3.1 to 3.7 times the maximum depth and 3.1 to 3.6 times the length of the head. Predorsal profile convex with a slight nuchal hump. Eyes inclined slightly upwards, the diameter 2.9 to 3.4 times in the length of the head and 1.05 to 1.2 times in the interorbital width. Snout bluntly pointed, 0.6 to 0.9 times the diameter of the eye. Mouth moderate, subterminal. Anterior barbel overlapping the base of the posterior barbel, 0.4 to 0.6 times the diameter of the eye. Posterior barbel extending well past the vertical to the centre of the eye, 0.6 to 0.9 times the eye diameter. Pit-lines of the *Beirabarus* type present on the side of the snout, the cheek, the operculum and on the dorsal surface of the head, between the eyes. Pectoral fin 0.6 to 0.8 times the length of the head, the tip just overlapping the pelvic origin in the four smallest individuals (31–37 mm. S.L.). Last simple dorsal ray smooth, flexible, 0.8 to 1.0 times the length of the head. Tip of dorsal fin slightly rounded, distal margin concave. Dorsal fin rays III 7 (f.1) or III 8 (f.29). Anal fin rays III 5. The pelvic origin lies between the verticals to the third simple and the first branched dorsal rays. Caudal peduncle 1.1 to 1.4 times as long as deep. The lateral line dips to a maximum of the depth of half a scale row below the horizontal myoseptum in the anterior third of the body ; the two converge at a point in the verticals to the last anal fin rays. Lateral line scales 22 to 27 (modal number 24). Three and a half scales between the lateral line and the dorsal origin, 3½ scales between the lateral line and the mid-ventral line immediately in front of the pelvic origin and 2½ scales between the lateral line and the pelvic origin. Eleven (f.1) or 12 (f.29) scales round the caudal peduncle.

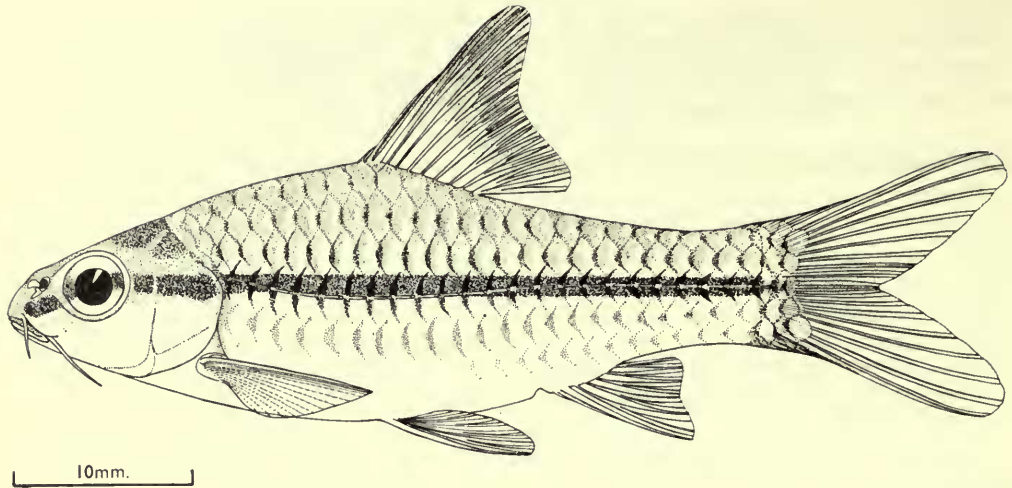


FIG. 1. *Barbus ablates*; N.B. in this and all following figures the caudal fin is simplified.

Summary of morphometric data based on 30 fish, 31–53 mm. S.L.; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth	27.5–33.3	29.6	—
Length head	27.6–32.5	29.8	Negative
Diameter eye	8.5–10.2	9.4	Negative
Interorbital width	9.8–11.2	10.5	—
Length snout	6.2–8.7	7.6	—
Length anterior barbel	3.8–5.9	4.5	—
Length posterior barbel	6.2–8.9	7.4	—
Length pectoral fin	19.6–23.7	21.7	—
Length dorsal fin	25.4–30.2	27.7	—
Length caudal peduncle	17.4–21.4	19.7	—
Depth caudal peduncle	14.2–15.9	15.3	—

COLORATION: *in living specimens*, greenish-brown above, silvery on the sides, whitish below. A conspicuous dark mid-lateral band runs from the snout to the posterior end of the body; the band frequently shows a brilliant green iridescence. Dorsal and caudal fins are tinged basally with yellow which becomes more intense towards the distal margin to merge with a terminal band of orange-red. Anal fin orange-red with a colourless free margin. Paired fins yellow on the anterior rays; the pelvic fins are also tinged with orange in brightly coloured individuals. Iris, orange-red above. *In formalin fixed specimens* the dorsal surface is densely pigmented with fine melanophores free from a narrow zone near the margin of each scale; the pigment-free zone becomes wider on more lateral scales. Dorsal and lateral scales are outlined with larger and darker melanophores, more concentrated in a vertical bar on the pocket of each scale to form a regular pattern. These markings are heaviest on the lateral line scales each of which bears a narrow vertical

stripe in the shape of a cupid's bow. A black mid-lateral band, one third of a scale row in depth, runs from the side of the snout, across the operculum and along the body to the tip of the caudal peduncle. There are scattered melanophores on the pockets of the first and sometimes the second scale row below the lateral line but the ventral surface is generally pigment-free. The anterior margin of the dorsal fin appears greyish-black owing to a moderately heavy peppering of melanophores on the membrane between the second and third simple rays, along the anterior margin of the distal half of the third simple ray and to a lesser extent on the second simple ray and on the membrane between the third simple and first branched rays. Pigmentation on the remainder of the fin is restricted to scattered and inconspicuous melanophores chiefly on the distal parts.

DIAGNOSIS AND AFFINITIES: Dr. Greenwood recently compared the syntypes of *B. ablables* in the Leyden Museum with material from the Kotchwah River, south Ghana (Brit. Mus. (N.H.) reg. no. 99.12.22.46-55) which has been used to supplement the above description. He found (*pers. comm.*) that the two collections were identical in barbel length and in details of pigmentation not lost in preservation. There was no sign in the type specimens of particularly heavy pigment in the region of the second simple dorsal ray (a heavily pigmented second simple ray is characteristic of the closely related *B. macrops*).

Barbus ablables resembles *B. macrops* in morphometric details and in pigmentation. The most obvious difference is in the distribution of melanophores on the dorsal fin. In *B. ablables* moderately heavy pigment is distributed along the entire length of the second and third simple rays and the anterior margin thus appears uniformly grey; in *B. macrops* the second simple ray and the tips of the first to third branched rays are densely pigmented so that the dorsal fin has a broad black tip and a black streak down the lower half of the anterior margin. The part of the third simple ray lying between these two areas of dense pigment is almost clear of melanophores. The two species also differ in the form of the pocket pigment on the lateral line scales; in *B. ablables* the markings are relatively slender in the shape of a cupid's bow, whereas in *B. macrops* the markings are broader and triangular. *Barbus ablables* is readily separated from West African populations of *B. macrops* by the relatively longer posterior barbels (6.2-8.9 c.f. 2.5 to 5.1% S.L. in Ghanaian material). The relative length of the posterior barbel in *B. macrops*, however, varies geographically and a population from the Tibesti shows a slight overlap with *B. ablables* (5.1-6.6 in *B. macrops* c.f. 6.2-8.9% S.L.).

The relative diameter of the eye which Boulenger (1911) originally used to separate the two species is no longer of diagnostic value. This character also varies geographically in *B. macrops*, and in the Tibesti population the eyes are relatively smaller than in *B. ablables*.

The geographical distributions of *B. ablables* and *B. macrops* do not appear to overlap. *Barbus ablables* is recorded only from the forest rivers of south-west Ghana and Liberia whereas *B. macrops* is widespread throughout the savannah rivers of West Africa and the Chad basin.

Barbus ablables is easily distinguished from *B. spurrelli* by the dark mid-lateral band

and the denseness of the pocket pigment on the lateral line scales. In *B. spurrelli* the mid-lateral band is very faint and the pigmentation of lateral line scales is only slightly heavier than that of more dorsal scales.

Barbus ablables is compared with *B. parablables* in the description of that species.

DISTRIBUTION : in *Ghana*, common and widespread in forest streams and rivers in the southwest. Probably absent from the Volta Basin. *Elsewhere*, Dabo Crom, Guinea (type locality) ; Liberia (no locality given, Boulenger, 1911). The record of *B. ablables* from the St. Paul basin, Liberia (Schultz, 1942) is doubtful ; Dr. Weitzman of the Smithsonian Institution reports that the specimens appear to have no *Beirabarbus* type cephalic pit-lines (*pers. comm.*). *Barbus ablables* probably belongs to a faunal group restricted to the forest rivers of western Ghana, Côte d'Ivoire and Liberia. The group may also include *Alestes longipinnis* (Günther), *Petersius occidentalis* (Günther), *Nannocharax seiboldi* Schultz, *Barbus trispilus* (Bleeker) and *Eutropius mentalis* Blgr. among other species.

Barbus (Beirabarbus) spurrelli Boulenger, 1913

(Text-fig. 2)

Barbus spurrelli Boulenger, 1913, *Proc. zool. Soc. Lond.* : 51, pl. 3, fig. 1 ; *Idem*, 1916, *Cat. Afr. Fish.* 4 : 264, fig. 162.

Barbus ablables var. *spurrelli* Pellegrin, 1923, *Les poissons des eaux douces de l'Afrique occidentale* : 135, Paris.

Barbus spurrelli : Daget, 1952, *Mem. Inst. France. Afr. Noire*, no. 19 : 316, fig. 7.

LECTOTYPE : 67.8 mm. S.L., B.M. (N.H.) reg. no. 1911.11.27.1, from near Dunkwa (Prah Basin) south Ghana. We consider this fish to be the specimen illustrated in Boulenger, 1916, fig. 162.

DESCRIPTION based on 12 fish, 25–46 mm. S.L. from the River Azubone (Volta Basin), near Mpraeso, south Ghana. Body compressed. S.L. 3.25 to 3.5 times the maximum depth and 2.9 to 3.5 times the length of the head. Predorsal profile convex with a slight nuchal hump. Snout bluntly pointed, 0.85 to 1.1 times the diameter of the eye. Mouth moderate, subterminal. Anterior barbel 0.3 to 0.7 times the diameter of the eye, barely overlapping the base of the posterior barbel. Posterior barbel 0.6 to 0.95 times the diameter of the eye, the tip reaching the vertical to the posterior margin of the pupil. Eyes inclined slightly upwards, the diameter 3.25 to 3.85 times in the length of the head and 1.2 to 1.5 times in the interorbital width. Pit-lines of the *Beirabarbus* type present on the side of the snout, the cheek, the operculum and on the dorsal surface of the head, between the eyes. Pectoral fin 0.6 to 0.75 times as long as the head, sometimes (f.3) overlapping the pelvic origin. Last simple dorsal ray smooth, flexible, 0.75 to 0.85 times the length of the head. Apex of dorsal fin slightly rounded, distal margin concave. Dorsal fin rays III 7 (f.1) or III 8 (f.11). Anal fin rays III 5. The pelvic origin lies between the verticals of the first and second branched dorsal rays. Caudal peduncle 1.2 to 1.55 times as long as deep. The lateral line dips to a maximum of the depth of slightly over half a scale row below the horizontal myoseptum in the anterior third of the body ; the

two converge above the posterior anal fin rays. Lateral line scales 24 to 26 (modal number 25). Three and a half to $4\frac{1}{2}$ scales between the lateral line and the dorsal origin, $3\frac{1}{2}$ scales between the lateral line and the mid-ventral line immediately in front of the pelvic origin and 2 to $2\frac{1}{2}$ scales between the lateral line and the pelvic origin. Twelve scales round the caudal peduncle.

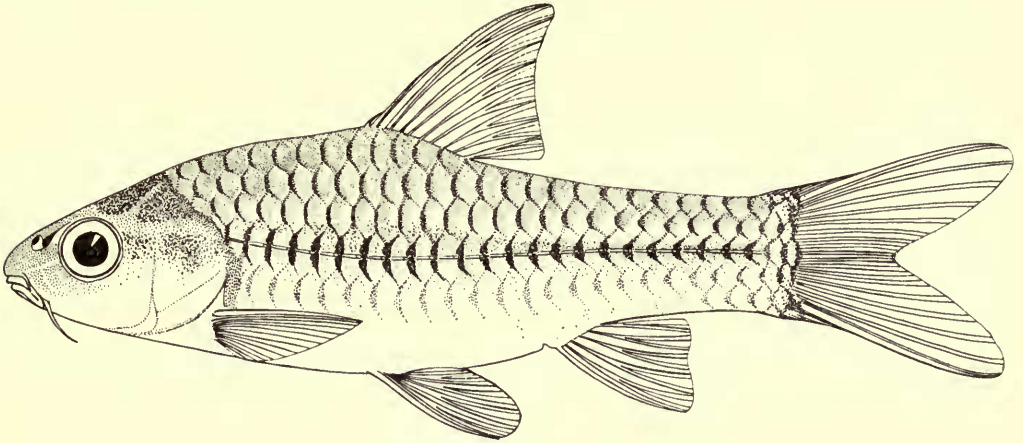


FIG. 2. *Barbus spurrelli*.

Summary of morphometric data based on 12 fish, 25 to 46 mm. S.L.; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth	28.3-30.5	29.3	—
Length head	28.5-33.0	31.5	Negative
Diameter eye	7.4-9.6	8.9	Negative
Interorbital width	10.8-13.0	11.7	—
Length snout	7.8-8.8	8.2	—
Length anterior barbel	3.2-5.8	4.7	—
Length posterior barbel	5.7-7.9	7.2	—
Length pectoral fin	18.6-24.6	22.2	—
Length dorsal fin	22.6-28.1	25.8	—
Length caudal peduncle	18.5-23.3	20.8	—
Depth caudal peduncle	14.3-15.1	14.6	—

COLORATION: *in formalin fixed specimens* the dorsal surface is relatively heavily pigmented with fine melanophores absent only from a narrow zone near the margin of each scale. Dorsal and lateral scales are outlined with larger and darker melanophores; this pigment is more concentrated in a vertical bar on the pocket of each scale to form a regular pattern. Lateral line scales are marked with similar but slightly heavier pigment; each vertical bar is bisected horizontally by the lateral line pore. Diffuse melanophores form an indistinct band, approximately one third of a scale row in depth, running just below the horizontal myoseptum in the anterior half of the body; the two converge over the anal fin and run together onto the caudal

peduncle where the band ends in front of a small and inconspicuous terminal spot, overlapping the base of the caudal fin. A narrow black band runs obliquely downwards from the lateral line origin to the base of the pectoral fin. The ventral surface is generally pigment-free, with the exception of a few scattered melanophores on the pockets of the first and sometimes the second row of scales below the lateral line. The snout is marked with a dark lateral spot. The anterior margin of the dorsal fin is moderately peppered with melanophores which are slightly heavier on the free edge of the last simple ray. Melanophores are thinly distributed over the distal half of the branched dorsal rays.

DIAGNOSIS AND AFFINITIES: these data are in close agreement (allowing for allometry) with the type description. *Barbus spurrelli* is readily distinguishable from other *Beirabarus* occurring in West Africa either by the absence of a dark mid-lateral band or by the lack of a dark spot on or near the tip of the dorsal fin. Detailed comparisons with *B. ablakes* and *B. parablakes* are given in the descriptions of those species.

DISTRIBUTION: *Ghana*. The type locality of *B. spurrelli* is Dunkwa (Prah basin) in the forest region of south Ghana. Our material was collected from the R. Azubone near Mpraeso, a forest stream on the Volta side of the Prah-Volta watershed. *Elsewhere*, Sierra Leone (Pellegrin, 1923); Mount Nimba, French Guinea (Daget, 1952). The record of *B. spurrelli* from the St. Paul basin, Liberia (Schultz, 1942) is doubtful. Dr. Weitzman of the Smithsonian Institution has kindly re-examined the material and reports that no *Beirabarus* cephalic pit-lines are visible (*pers. comm.*).

Barbus (Beirabarus) macrops Boulenger, 1911

(Text-fig. 3)

Barbus macrops Boulenger, 1911, *Ann. Mag. nat. Hist.* (8) 7 : 374; *Idem*, 1916, *Cat. Afr. Fish.* 4 : 265, fig. 163.

Barbus deserti: Pellegrin, 1921 (Ennedi and Tibesti specimens only), *Mem. Soc. Sci. nat. Maroc*, (1) 2 : 143.

Barbus macrops: Pellegrin, 1923, *Les poissons des eaux douces de l'Afrique occidentale* : 136, Paris.

Barbus gambiensis Svensson, 1933, *Kungl. Sven. vet. Handl.* (12) 3 : 67, pl. 4, fig. 1.

Mannichthys lucileae Schultz, 1942, *Proc. U.S. Nat. Mus.* 92 : 321, pl. 35, fig. 3.

Barbus deserti: Daget, 1954, *Mem. Inst. France. Afr. Noire*, no. 36 : 192, fig. 62.

Barbus ablakes: Blanc & Daget, 1957, *Mem. Inst. France. Afr. Noire*, no. 50 : 132, fig. 13.

LECTOTYPE: a fish of 45.0 mm. S.L. (Brit. Mus. (N.H.) reg. no. 1912.4.1.110), from above the rapids, Crobal River, Portuguese Guinea. We consider this to be the specimen illustrated in Boulenger, 1916, fig. 163.

DESCRIPTION based on 24 fish, 31 to 56 mm. S.L. from a tributary of the White Volta, 5 m. N. of Bawku, northern Ghana. Body moderately compressed. S.L. 3.3 to 3.9 times the maximum depth and 3.3 to 3.7 times the length of the head. Predorsal profile convex with a slight nuchal hump. Snout bluntly pointed, 0.7 to 0.85 times the diameter of the eye. Mouth moderate, sub-terminal. Barbels moderate, the anterior 0.1 to 0.35 times the diameter of the eye, the tip barely over-

lapping the base of the posterior barbel. Posterior barbel 0.25 to 0.6 times the eye diameter, the tip reaching the vertical to the centre of the eye in a few individuals. Eyes inclined slightly upwards, 2.85 to 3.1 times in the length of the head and 1.05 to 1.15 times in the interorbital width. Pit-lines of the *Beirabarus* type fully developed on the side of the snout, the cheek, the operculum and on the dorsal surface of the head between the eyes. Pectoral fin 0.65 to 0.8 times the length of the head, the tip always falling short of the pelvic origin. Last simple dorsal ray, smooth, flexible, 0.9 to 1.05 times the length of the head. Apex of dorsal fin slightly rounded, distal margin concave. Dorsal fin rays III 7 (f.1) or III 8 (f.23). Anal fin rays III 5. The origin of the dorsal fin lies between the verticals to the last simple and first branched dorsal rays. Caudal peduncle 1.3 to 1.6 times as long as deep. The lateral line dips to a maximum depth of slightly over half a scale row below the horizontal myoseptum in the anterior third of the body; the two converge in the vertical to the last anal fin rays. Lateral line scales 24 to 28 (modal number 25). Three and a half scales between the lateral line and the dorsal origin, $3\frac{1}{2}$ scales between the mid-ventral line immediately in front of the pelvic origin and $2\frac{1}{2}$ scales between the lateral line and the pelvic origin. Twelve scales round the caudal peduncle.

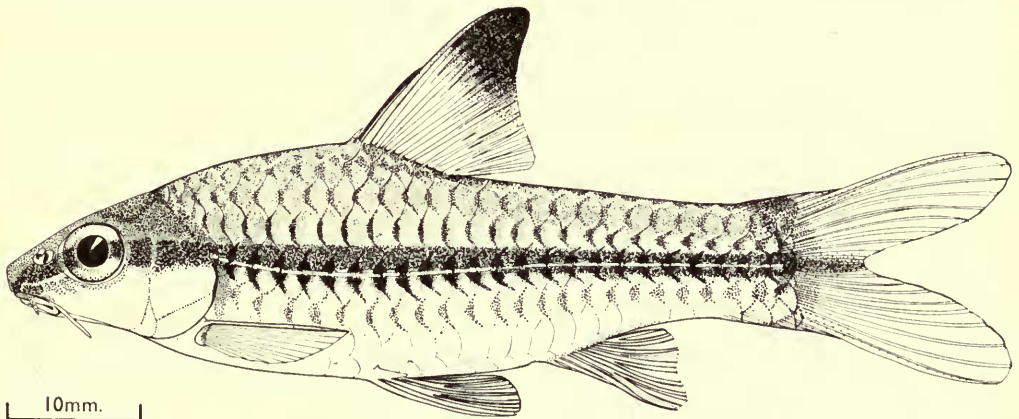


FIG. 3. *Barbus macrops*.

Summary of morphometric data based on 24 fish, 31 to 56 mm. S.L.; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth	25.5-30.2	27.1	—
Length head	26.4-29.7	27.6	Negative
Diameter eye	8.3-10.2	9.1	Negative
Interorbital width	9.2-12.2	10.2	—
Length snout	6.3-7.3	6.8	—
Length anterior barbel	1.2-3.1	2.3	—
Length posterior barbel	2.5-5.1	3.5	—
Length pectoral fin	17.8-21.8	19.7	—
Length dorsal fin	25.2-28.8	26.6	—
Length caudal peduncle	18.1-21.1	19.9	—
Depth caudal peduncle	13.3-14.8	14.1	—

COLORATION: *in living specimens*, greenish-brown above, silvery on the sides, whitish below. A dark mid-lateral band extends from the snout to the tip of the caudal peduncle. Dorsal and caudal fins bright orange-red, the dorsal with a conspicuous black tip. The other fins are frequently tinted orange-yellow. Iris, bright orange-red above. *In formalin fixed specimens* the dorsal surface is densely pigmented with fine melanophores absent only from a narrow zone near the margin of each scale. Dorsal and lateral scales are clearly outlined with larger and darker melanophores which are more concentrated in a vertical line on the pocket of each scale to form a regular pattern. These markings are heaviest on the lateral line where each scale bears a relatively broad and triangular group of melanophores, bisected horizontally by the lateral line pore. A conspicuous black band, one-third of a scale row in depth, runs mid-laterally from the side of the snout, across the operculum and along the body to the end of the caudal peduncle. In some specimens an oblique dark stripe is noticeable between the origin of the lateral line and the base of the pectoral fin. The pattern of scale pocket pigment, described above for dorsolateral scales, is repeated more faintly on the first and sometimes the second scale row below the lateral line. The ventral surface is generally pigment-free. The apex of the dorsal fin bears a dense black spot extending over the distal third of the first four branched rays but heaviest on the tips of the first two. Dense pigment is also present in the vicinity of the second simple ray, particularly on the membrane between it and the third ray. The third simple ray is less heavily pigmented and closely packed melanophores are present only in the basal third along the anterior margin and near the tip; the central section of the third simple ray is almost pigment-free.

GEOGRAPHICAL VARIATION: during the present investigations, *B. macrops* were examined from most of the savannah region of West Africa, the Chad Basin, the Hoggar in the western Sahara and the Tibesti in the eastern Sahara. Details of pigmentation, particularly on the dorsal fin, proved to be constant throughout this wide area. Marked geographical variation was however noted in certain morphometric characters, especially eye diameter but also the relative length of the barbels as demonstrated below:

B. macrops: geographical variations in eye diameter (N.B.—negative allometry).

Locality	No. examined	Range S.L. (mm.)	Eye diameter expressed as % S.L.
Tibesti	24	43-55	6.2-7.6
Niger (N. Nigeria)	3	48-60	7.8-8.6
Sierra Leone	2	61	8.0-8.4
Volta (N. Ghana)	24	31-56	8.3-10.2
Volta (S. Ghana)	17	21-52	8.2-10.6
Hoggar	4	26-39	8.6-10.0
Chad Basin (Nigeria)	12	27-48	9.0-10.2
Port. Guinea	16	25-60	8.8-11.6

B. macrops: geographical variations in posterior barbel length.

Locality	No. examined	Range S.L. (mm.)	Length post. barbel expressed as % S.L.
Chad Basin (Nigeria)	12	27-48	2.4-3.3
Volta (N. Ghana)	24	31-56	2.5-5.1
Volta (S. Ghana)	17	21-52	2.7-6.0
Hoggar	4	26-39	3.0-5.1
Port. Guinea	16	25-60	3.0-5.3
Sierra Leone	2	61	4.5-5.1
Niger (N. Nigeria)	3	48-60	4.8-5.4
Tibesti	24	43-55	5.1-6.6

Diagnosis and Affinities : there has been considerable confusion between *B. macrops* and *B. deserti* Pellegrin. This undoubtedly originated from the inclusion of *B. macrops* (localities Tibesti and Ennedi) in material used for a redescription of *B. deserti* (Pellegrin, 1921).

We have examined type material of *B. deserti* from the Tassili des Azdjers, central Sahara, both the syntypes in the Paris Museum (reg. no. 09.457-458) and a syntype in the British Museum (N.H.) (reg. no. 1909.12.9.7) on which Boulenger (1911) based his diagnosis. They all differ from *B. macrops* in the following details :

(a) In *B. deserti* there is no well-defined mid-lateral band running from the snout across the operculum to the tip of the caudal peduncle. *Barbus deserti* is marked only in the posterior half of the body with relatively faint dark pigment on the horizontal myoseptum.

(b) The lateral line scales are relatively narrower and deeper in *B. deserti* (cf. *B. parablabe*).

(c) The lateral line scale pockets of *B. deserti* are marked with narrow vertical stripes (cf. *B. parablabe*), never with broader triangular spots as in *B. macrops*.

(d) The second simple dorsal fin ray (always dense black in *B. macrops*) is only lightly pigmented.

(e) Further details of pigmentation of the dorsal fin in *B. deserti* are obscured by damage to the tip in all the type material. Pellegrin (1909) noted that the dorsal fin was tipped with black whereas Boulenger (*op. cit.*) records that a spot was present near the tip. It seems likely that Boulenger's description is the more accurate of the two. Three *Barbus* from the oasis of El Barkat, Fianferrari, Fezzan (within 500 miles of the type locality in the same region of the N. Central Sahara) in the British Museum (N.H.) (reg. no. 1937.7.8.4-6), similar to the types in every respect, bear a spot on the distal half of the last simple and first three branched dorsal rays, well clear of the distal margin. This should prove a trenchant character in distinguishing *B. deserti* from *B. macrops* where the black pigment extends to the tip of the anterior dorsal rays.

Comparisons of *B. macrops* with *B. ablabe* and *B. parablabe* are included in the descriptions of those species.

DISTRIBUTION AND HABITAT : in *Ghana*, restricted to the Volta basin where it is the most common and widespread species of *Barbus*. *Barbus macrops* occurs in rivers, well vegetated lakes and dams, over all substrates coarse and fine. *Elsewhere*,

distributed over most of the savannah area of West Africa and the Chad basin, extending into the Sahara in the Hoggar to the west and the Tibesti to the east: Portuguese Guinea (Boulenger, 1911, type locality); Gambia River (Svensson, 1933); L. Kwarko, Sierra Leone (Brit. Mus. (N.H.) reg. no. 1958.9.18.54-55); St. Paul and Bolor Rivers, Liberia (Schultz, 1942); Middle Niger (Daget, 1954); Arak Gorge, Hoggar (Brit. Mus. (N.H.) reg. no. 1932.5.6.5-11); R. Katagum (Chad Basin) N. Nigeria (Brit. Mus. (N.H.) reg. no. 1928.7.3.56-62); Sherda, Tibesti (Brit. Mus. (N.H.) reg. no. 1960.6.7.111-160).

LIFE HISTORY: in the White Volta, *B. macrops* spawns during the rains. Gonads start to mature during April and the majority of fish are ripe by mid-June when the first post-larvae appear in the river. Spawning is over by the end of July and the size-composition of samples taken in August suggests that most fish die at the age of one year. Juvenile fish have grown to a modal length of *c.* 35 mm. by November. Females, which ripen at a minimum S.L. of *c.* 50 mm, grow slightly larger than males. Maximum size, a female of 98 mm. S.L.

***Barbus (Beirabarus) parablades* Blanc & Daget, 1957**

(Text-fig. 4)

Barbus parablades Blanc & Daget, 1957, *Mem. Inst. France. Afr. Noire*, no. 50: 134, fig. 13.

HOLOTYPE: a fish 62 mm. S.L. from between Tanguieta and Natitingou, Volta basin, N. Dahomey, Paris Mus. reg. no. 56-108.

DESCRIPTION based on 24 fish, 39-52 mm. S.L. from the waterworks reservoir at Tamale (Volta basin), northern Ghana. Body moderately compressed. S.L. 3.3 to 3.9 times the maximum depth and 3.2 to 3.6 times the length of the head. Predorsal profile convex with a slight nuchal hump in the larger individuals (*c.* 45 mm. S.L. and over). Snout bluntly pointed, 0.6 to 0.8 times the diameter of the eye. Mouth moderate, subterminal. Barbels moderate, the anterior 0.25 to 0.4 times the diameter of the eye, its tip reaching the base of the posterior barbel. Posterior barbel 0.45 to 0.6 times the diameter of the eye, the tip extending to between the verticals to the anterior margin and the centre of the pupil. Eyes inclined slightly upwards, the diameter 2.95 to 3.35 times in the length of the head and 1.0 to 1.15 times in the interorbital width. Well developed *Beirabarus* type pit-lines on the side of the snout, the cheek, the operculum and on the dorsal surface of the head between the eyes. Pectoral fin rather long, 0.7 to 0.85 times the length of the head, the tip frequently overlapping the pelvic origin, particularly in smaller males. Last simple dorsal ray smooth, flexible, 0.9 to 1.0 times the length of the head. Apex of dorsal fin slightly rounded, distal margin concave. Dorsal fin rays III 7 (f.1) or III 8 (f.23). Anal fin rays III 5. The pelvic origin lies between the verticals to the last simple and first branched dorsal fin rays. Caudal peduncle slender, 1.4 to 1.8 times as long as deep. The lateral line dips to a maximum of slightly more than the depth of half a scale row below the horizontal myoseptum in the anterior third of the body; the two converge in the vertical to the anal fin, usually over the anterior rays. Lateral

line scales 23 to 27 (modal number 25). Three and a half scales between the lateral line and the dorsal origin, $3\frac{1}{2}$ scales between the lateral line and the mid-ventral line immediately in front of the pelvic origin and $2-2\frac{1}{2}$ scales between the lateral line and the pelvic origin. Nine (f.1), 10 (f.18) or 11 (f.5) scales round the caudal peduncle ; the odd row of scales, when present always lies along the mid-ventral line (N.B.—Daget records only 12 scales round the caudal peduncle in the type description).

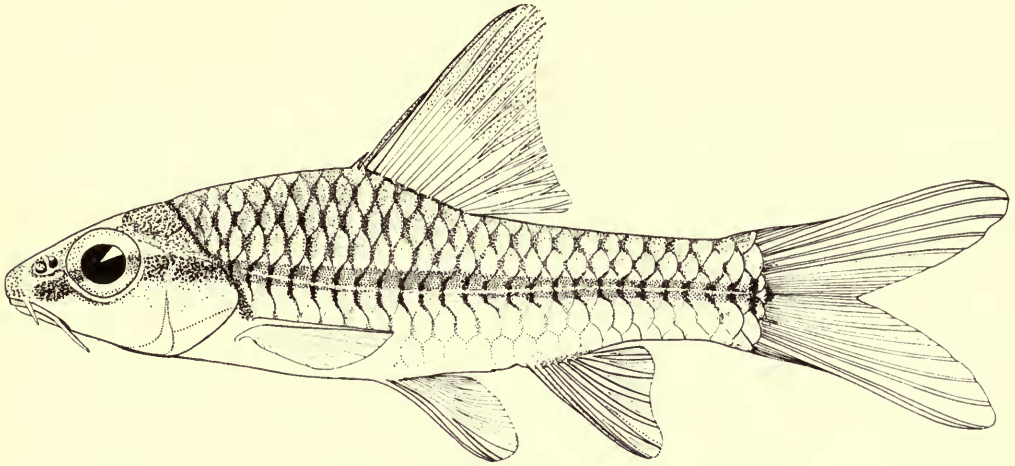


FIG. 4. *Barbus parablabe*.

Summary of morphometric data based on 24 fish, 39 to 52 mm. S.L. ; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth . . . . .	. 25.8-29.6	27.5	—
Length head . . . . .	. 27.3-30.7	28.9	—
Diameter eye . . . . .	. 8.9-9.7	9.3	—
Interorbital width . . . . .	. 8.9-10.4	9.8	—
Length snout . . . . .	. 6.4-7.6	6.9	—
Length anterior barbel . . . . .	. 2.5-3.6	2.9	—
Length posterior barbel . . . . .	. 4.1-5.7	4.9	—
Length pectoral fin . . . . .	. 21.2-24.7	23.0	—
Length dorsal fin . . . . .	. 26.8-31.2	28.0	—
Length caudal peduncle . . . . .	. 20.0-24.0	22.0	—
Depth caudal peduncle . . . . .	. 13.1-14.4	13.7	—

COLORATION : *in living specimens*, dorsal surface greyish green, flanks silvery, whitish below. A greyish mid-lateral band is punctuated with short dark vertical streaks on the lateral line. Caudal and dorsal fins clear rose-pink, the dorsal less brightly coloured than the caudal ; all other fins colourless. Iris reddish above. *In formalin-fixed specimens*, dorsal surface with a moderately heavy scattering of fine melanophores, free from a narrow zone near the margin of each scale ; the clear zone becomes increasingly wide on the flanks. Dorsal and lateral scales are outlined

with larger and darker melanophores which are more concentrated in a vertical band on the pocket of each scale to form a regular pattern. Pocket pigment is particularly heavy on the lateral line where each scale is marked with a conspicuous crescent-shaped vertical stripe traversed by the lateral line pore. A well-marked band of diffuse melanophores, one third of a scale row in depth, runs mid-laterally from the side of the snout, across the operculum, to the tip of the caudal peduncle. The ventral surface is generally pigment free with the exception of scattered melanophores on the pockets of the first and sometimes the second row of scales below the lateral line. The dorsal fin is relatively lightly peppered with melanophores chiefly on the second simple ray and on the distal halves of the third simple and first three branched rays. This pigment is sometimes more concentrated towards the apex of the fin but never enough to form a definite spot. Fine lines of black pigment are frequently present on the anterior and posterior edges of the fin rays particularly in the basal half of the fin; this may produce a streaky appearance.

DIAGNOSIS AND AFFINITIES: *Barbus parablades* is readily distinguished from *B. macrops* (with which it usually occurs in North Ghana) by the absence of a heavy black spot at the tip of the dorsal fin, the relative lightness of the lateral band and the slender crescentic markings on the pockets of the lateral line scales (broader and triangular in *B. macrops*). The lateral line scales themselves are narrower and deeper in *B. parablades*. The caudal peduncle is more slender in *B. parablades*, and in northern Ghana the lower number of scales round the caudal peduncle (9-11 cf. 12 in *B. macrops*) is diagnostic. However, as noted above, 12 scales round the caudal peduncle were recorded in the type material of *B. parablades* from north Dahomey (Blanc & Daget, 1957). The pectoral fin is relatively longer in *B. parablades*, frequently overlapping the pelvic origin in the smaller males (never in *B. macrops*.) In living specimens the pale pink of the caudal fin is strikingly different to the bright orange red of *B. macrops*.

Most of the above characters also serve to distinguish *B. parablades* from *B. ablades*. Both species are, however, without a black tip to the dorsal fin and the stripes on the lateral line scale pockets are only slightly broader in *B. ablades* than in *B. parablades*. The shorter posterior barbel of *B. parablades* (4.9-5.7 cf. 6.2-8.9% in *B. ablades*) is diagnostic.

Compared with *B. spurrelli*, *B. parablades* has a shorter snout (6.4-7.6 cf. 7.8-8.8% S.L.), shorter posterior barbels (4.1-5.7 cf. 5.7-7.9% S.L.) and a narrower caudal peduncle (13.1-14.4 cf. 14.3-15.1% S.L.). The dark mid-lateral band is much heavier in *B. parablades* and the vertical lines of pigment on the lateral line scales are narrower and more emphasized; in *B. spurrelli* there is relatively little contrast between the pigmentation of the lateral line and more dorsal scales.

DISTRIBUTION AND HABITAT: in Ghana, widespread and common throughout the northern region in rivers, streams and dams. Occurs over all substrates though rarely in thickly vegetated habitats. No records from the south or from outside the Volta basin. *Elsewhere*, recorded from a tributary of the River Oti (Volta basin) in north Dahomey (type locality).

NATURAL HISTORY: *Barbus parablabe* spawns during the rains. Gonads start to mature during April and by mid-June the majority of fish are ripe. Juveniles appear in the rivers during July and by mid-August the larger mature fish have disappeared, suggesting that death occurs after breeding, at the age of approximately one year. Females grow larger than males. Maximum size: a female of 53 mm. S.L.

***Barbus hypsolepis* Daget, 1959**

(Text-fig. 5)

Barbus hypsolepis Daget, 1959, *Bull. Inst. France. Afr. Noire*, 21 (A), 2: 670, fig. 1.

DESCRIPTION based on 21 specimens 14–27 mm. S.L. from the Black Volta, 3 miles west of Lawra, north Ghana. Body moderately compressed. S.L. 3.65 to 4.15 times the maximum depth and 3.05 to 3.90 times the length of the head. Pre-dorsal profile smooth, convex. Snout somewhat pointed, 0.4 to 0.7 times as long as the diameter of the eye. Mouth moderate, subterminal and protrusible obliquely downwards. Weakly-developed pit-lines clearly visible on the cheeks. Anterior barbel 0.03 to 0.25 times the diameter of the eye, the tip overlapping the base of the posterior barbel only in the larger specimens. Posterior barbel 0.05 to 0.45 times the diameter of the eye, the tip extending in larger specimens beyond the vertical to the anterior margin of the pupil. Eyes large, inclined slightly upwards, 2.35 to 2.95 times in the length of the head and 0.85 to 1.05 times in the interorbital width. Pectoral fin 0.55 to 0.75 times the length of the head, the tip falling short of the pelvic origin. Last simple dorsal ray smooth, flexible, 0.9 to 1.05 times as long as the head. Apex of dorsal fin pointed, distal margin concave. Dorsal fin-rays III 8. Anal fin-rays III 5. Origin of pelvic fin below the vertical to the last simple dorsal ray. Caudal peduncle slender, 1.55 to 1.9 times as long as deep. The lateral line scales are unusually deep, particularly below the origin of the dorsal fin. The lateral line dips to a maximum of the depth of a third of a scale row below the horizontal

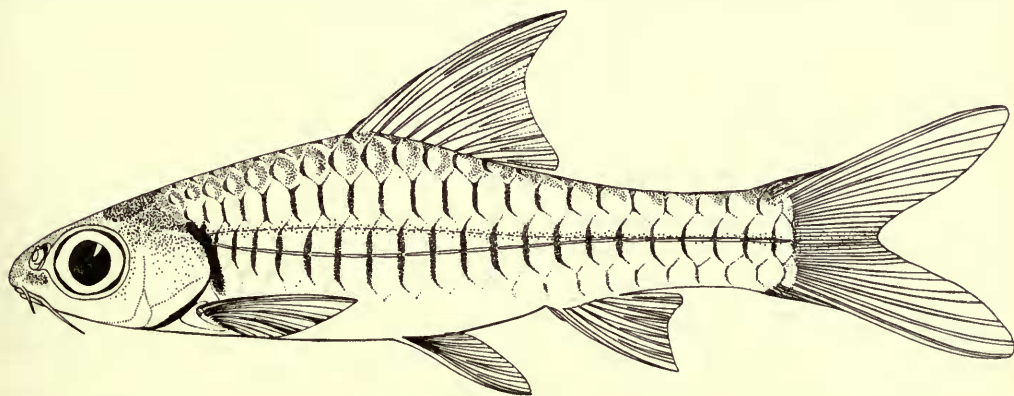


FIG. 5. *Barbus hypsolepis*.

myoseptum in the anterior third of the body; the two converge in the vertical to the base of the anal fin. Lateral line scales 22 to 24 (modal number 23). Two and a half scales between the lateral line and the dorsal origin, $2\frac{1}{2}$ scales between the lateral line and the mid-ventral line immediately in front of the pelvic origin and $1\frac{1}{2}$ scales between the lateral line and the pelvic origin. Eight scales round the caudal peduncle.

Summary of morphometric data based on 21 fish, 14 to 27 mm. S.L.; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth	23.5-27.8	25.5	—
Length head	25.6-32.4	28.8	Negative
Diameter eye	9.7-12.8	10.7	—
Interorbital width	9.7-11.0	10.4	—
Length snout	4.7-7.1	5.8	—
Length anterior barbel	0.1-2.6	1.2	Positive
Length posterior barbel	0.6-4.6	2.4	Positive
Length pectoral fin	16.8-22.5	19.0	—
Length dorsal fin	25.8-30.4	27.3	—
Length caudal peduncle	19.6-23.9	21.4	—
Depth caudal peduncle	11.8-14.0	12.5	—

COLORATION: *in living specimens*, body nacreous silver with a pinkish flush on the dorsal surface. Scales clearly outlined with dark pigment. Dorsal and caudal fins pale pinkish-orange, anal and paired fins tinged with the same colour. Iris with an orange-red arc above. Daget (1959) noted that in *B. hypsolepis* from the Middle Niger, females are less brightly coloured than males and have a greyish dorsal fin. *In formalin-fixed specimens* scales of the lateral line and above are clearly outlined with dark pigment which is emphasized in a slender, vertical arc of melanophores on each scale pocket. A few scattered melanophores form an indistinct band on the horizontal myoseptum, more noticeable in the posterior half of the body. There is frequently a dark bar of pigment immediately behind the operculum, running obliquely downwards from the lateral line to the base of the pectoral fin. Daget (*op. cit.*) has observed that in *B. hypsolepis* this bar is present only in males.

DIAGNOSIS: these data agree closely (allowing for allometry) with the original description of material from the Middle Niger (Daget, *op. cit.*). Daget includes *B. hypsolepis* in the subgenus *Clypeobarbus* which differs from other *Barbus* in having exceptionally deep lateral line scales, particularly in the region below the origin of the dorsal fin. He observes that when more material becomes available it may be possible to consider *B. hypsolepis* as a subspecies of *B. pleuropholis*, a species occurring in the Congo basin.

DISTRIBUTION: *in Ghana* local and uncommon, known only from the Black Volta near Lawra and from the White Volta near Bolgatanga. *Elsewhere*, the Middle Niger (Daget, *op. cit.*).

Barbus nigeriensis Boulenger, 1902

(Text-fig. 6)

Barbus nigeriensis Boulenger, 1902, *Proc. zool. Soc. London*, 2 : 327, pl. 28, fig. 3. ; *Idem*, 1910 (type only), *Cat. Afr. Fish*, 2 : 154, fig. 130.

[*non Barbus nigeriensis* : Trewavas, 1947, in Irvine, *Fisheries and Fish of the Gold Coast*, London ; *non Barbus nigeriensis* : Blanc & Daget, 1957, *Mem. Inst. France. Afr. Noire*, no. 50 : 135, fig. 14.]

DESCRIPTION based on 20 fish, 23 to 50 mm. S.L., from the White Volta and its tributaries near Bawku, northern Ghana. Body moderately compressed. S.L. 3.2 to 4.1 times the maximum depth and 3.2 to 4.1 times the length of the head. Pre-dorsal profile convex with a slight nuchal hump. Snout rather pointed, 0.65 to 0.9 times in the diameter of the eye. Mouth relatively large, subterminal. Barbels long, the anterior 0.65 to 1.2 times the diameter of the eye, and the posterior 0.8 to 1.4 times the diameter of the eye. In larger specimens the tip of the anterior barbel reaches the vertical to the centre of the eye and the tip of the posterior barbel extends beyond the posterior margin. Eyes inclined slightly upwards, relatively large, 2.5 to 3.2 times in the length of the head and 0.95 to 1.2 times in the interorbital width. Weakly-developed pit-lines are visible on the cheek and operculum. Pectoral fin 0.55 to 0.75 times the length of the head, the tip not reaching the pelvic origin. Last simple dorsal ray smooth, flexible, 0.8 to 1.0 times as long as the head. Apex of dorsal fin somewhat rounded, distal margin slightly concave. Dorsal fin rays III 8 (f.19) or III 9 (f.1). Anal fin rays III 5. The origin of the pelvic fin lies between the verticals to the first and third branched dorsal fin rays. Caudal peduncle 1.35 to 1.55 times as long as deep. The lateral line dips to a maximum of approximately one and a quarter scale rows below the horizontal myoseptum in the anterior third of the body ; the two converge in the vertical to the base of the anal fin. Lateral line scales 27 to 30 (modal number 29). Four and a half scales between the lateral lines and the dorsal origin, $3\frac{1}{2}$ to $4\frac{1}{2}$ scales between the lateral line and the mid-ventral line immediately in front of the pelvic origin and $2\frac{1}{2}$ scales between the lateral line and the pelvic origin ; 12 scales round the caudal peduncle.

COLORATION : *in living specimens* greenish-brown above, silvery on the flanks and whitish below. A dark narrow mid-lateral band is present. Dorsal and caudal fins clear pale pink. The eye is marked with a red crescent over the pupil. *In formalin-fixed specimens* scales of the dorsal surface with dense melanophores, free from a narrow marginal band and less dense at the centre of each scale. This pattern, which is darkest on the scales at the base of the dorsal fin, fades out rather abruptly on the flanks. Dense melanophores lying over the horizontal myoseptum form a narrow dark band running the entire length of the body. The band is generally less than a scale row in depth, becoming slightly wider on the caudal peduncle and frequently more dense at the tip to form a vague spot. The band may be interrupted below the anterior rays of the dorsal fin but never enough to form distinct spots or streaks. The scale pockets of the lateral line are each marked with a compact group of melanophores bisected horizontally by the lateral line pore. Similar markings may appear

faintly on the scale row below the lateral line, but apart from an indistinct group of melanophores at the base of the anal fin the ventral surface is generally pigment-free.

DIAGNOSIS AND AFFINITIES: the original description of *B. nigeriensis* (*op. cit.*) was based on a poorly preserved holotype (Brit. Mus. (N.H.) reg. no. 1902.10.25.2) lacking any obvious pigment. We believe that Boulenger (1911) later mistook other superficially similar specimens for *B. nigeriensis*, resulting in his observations that the markings are a "broad black lateral band which may be broken up into a series of spots or streaks". Such a broken band is not characteristic of *B. nigeriensis* and the description has tended to confuse subsequent workers. *Barbus nigeriensis* material in the British Museum (N.H.) thus included examples of *B. wernerii* Boulenger, *B. laurae* and *B. sublineatus*. The holotype is now in poor condition. Pigment is restricted laterally to microscopic melanophores in a longitudinal line on the caudal peduncle, grouped closer together at the posterior end to suggest a spot. Allowing for features lost by deterioration, the holotype corresponds closely with our own material from northern Ghana. Three fish from the Ogun River, Western Nigeria (Brit. Mus. (N.H.) reg. no. 1956.9.6.57-59) must also be regarded as authentic *B. nigeriensis*; the pigmentation is identical with that of the specimens from Ghana. Data from the three collections are tabulated below. Measurements are expressed as percentages of the standard length. Means are given in parentheses.

	Holotype Agberi River, Lower Niger	Ogun River, S. Nigeria	White Volta, N. Ghana
Number of specimens . . .	1	3	20
Standard length (mm.) . . .	42	45-50	24-50
Maximum depth	25.2	32.2-35.0 (33.2)	24.5-29.7 (26.8)
Length head*	23.7	22.7-23.7 (23.4)	24.5-31.3 (28.7)
Diameter eye*	8.5	7.7-8.0 (7.8)	7.6-11.8 (9.9)
Length snout	5.7	5.6-6.0 (5.8)	6.4-8.3 (7.5)
Interorbital width	8.1†	9.3-9.8 (9.5)	9.3-11.8 (10.4)
Anterior barbel	6.4†	7.9-8.6 (8.2)	7.4-10.0 (9.1)
Posterior barbel	7.8†	10.6-11.0 (10.8)	8.5-12.0 (10.8)
Length pectoral fin	17.2	17.5-19.4 (18.6)	17.3-21.4 (19.6)
Length dorsal fin	—	22.6-22.8 (22.7)	23.0-27.9 (25.0)
Length caudal peduncle	20.1	17.9-20.0 (19.0)	17.8-20.5 (19.3)
Depth caudal peduncle	12.8	13.0-13.1 (13.0)	12.6-14.7 (13.7)
Number lateral line scales	c. 27	28-29	27-30
Scales lateral line to dorsal origin	4½	4½	4½
Scales lateral line to vent. mid-line.	3½	4½	4½

* Negative allometry; † somewhat shrivelled.

Barbus nigeriensis appears to have no close relatives. It resembles *B. chlorotaenia* Boulenger in pigmentation and barbel length but in that species the lateral line dips less markedly below the longitudinal myoseptum and the mouth is smaller and set more obliquely, with the lips folding characteristically round the base of the posterior

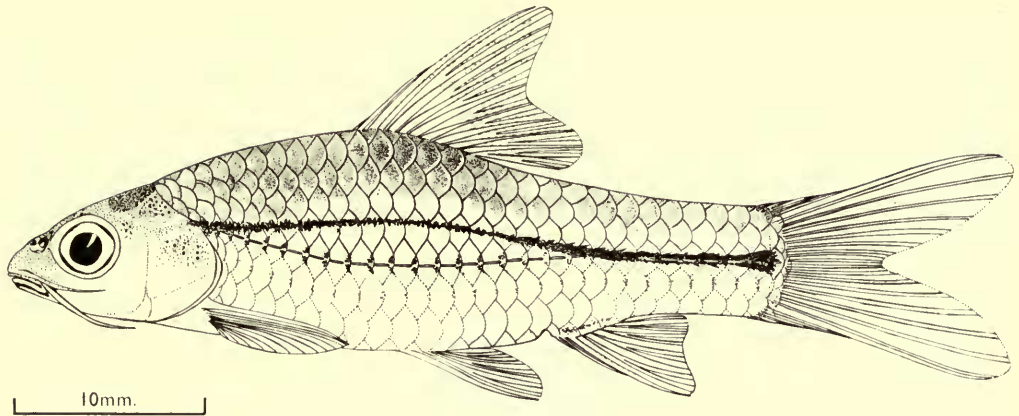


FIG. 6. *Barbus nigeriensis*.

barbel in the form of a socket. The combination of relatively large eyes, large mouth, long barbels and the narrow and continuous lateral band widening on the caudal peduncle should prevent the confusion of *B. nigeriensis* with other species.

HABITAT AND DISTRIBUTION: *in Ghana*, an uncommon species found in small numbers in the White Volta and its tributaries in north-eastern Ghana. All examples were from running water. *Elsewhere*, the Agberri River, a tributary of the Lower Niger (type locality) and the Ogun River, both in south Nigeria.

***Barbus lawrae* Hopson, 1965.**

(Text-fig. 7)

Barbus lawrae Hopson, 1965, *Rev. Zool. Bot. Afr.* 71: 245.

HOLOTYPE: a female of 42 mm. S.L. from Lissa Dam on the Kamba River (a tributary of the Black Volta), 15 miles north-east of Lawra, north-west Ghana, 25.x.61, British Museum (N.H.) reg. no. 1964.9.8.1.

DESCRIPTION based on the holotype and 23 of the paratypes, 32–47 mm. S.L., from Lissa Dam. Body compressed, particularly near the dorsal surface. S.L. 2.95 to 3.65 times the maximum depth and 3.4 to 3.75 times the length of the head. Predorsal profile convex with a slight nuchal hump. Snout rather pointed, 0.55 to 0.75 times the diameter of the eye. Mouth moderate, subterminal. Anterior barbel 0.1 to 0.4 times the diameter of the eye, the tip barely overlapping the base of the posterior barbel. Posterior barbel 0.3 to 0.8 times the diameter of the eye, the tip reaching the vertical to the posterior margin of the pupil in the largest individuals.

Eyes inclined slightly upwards, 2.75 to 3.1 times in the length of the head and 1.0 to 1.1 times in the interorbital width. Weakly-developed pit-lines visible on the cheeks. Pectoral fin 0.7 to 0.8 times as long as the head, the tip falling short of the pelvic origin. Last simple dorsal ray smooth, flexible, rather long, 1.0 to 1.2 times the length of the head. Apex of the dorsal fin slightly rounded, distal margin concave. Dorsal fin rays III 8. Anal fin rays III 5. The origin of the pelvic fin lies between

the verticals to the first and second branched dorsal rays. Caudal peduncle 1.3 to 1.6 times as long as deep. The lateral line dips to a maximum of the depth of one and a third scale rows below the horizontal myoseptum in the anterior third of the body; the two converge in the centre of the caudal peduncle. Scales radially striated. Lateral line scales 28 to 31 (modal number 30). Four and a half to 5½ scales between the lateral line and the dorsal origin, 4½ scales between the lateral line and the mid-ventral line immediately in front of the pelvic origin and 2½ scales between the lateral line and the pelvic origin. Twelve scales round the caudal peduncle.

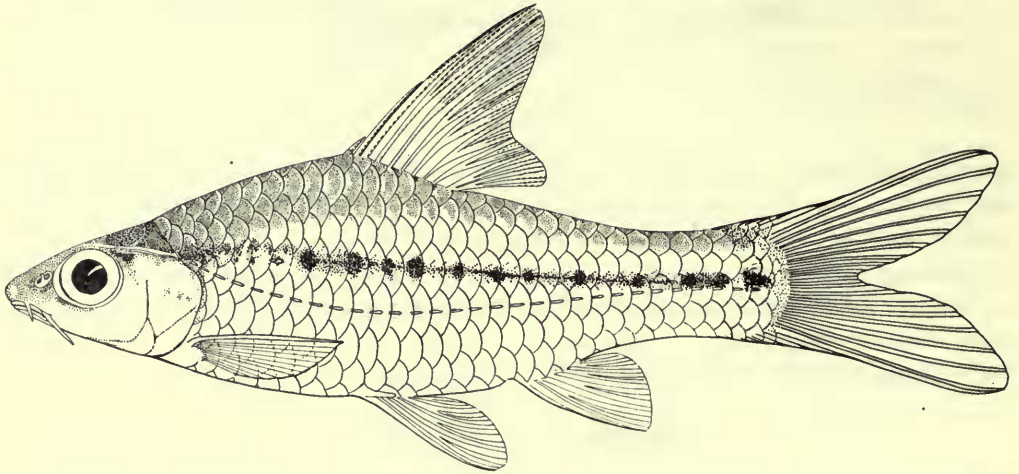


FIG. 7. *Barbus lawrae*.

Summary of morphometric data based on 24 fish, 32 to 47 mm. S.L.; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth	27.2-33.3	30.3	—
Length head	26.6-29.3	27.6	Negative
Diameter eye	9.1-10.0	9.7	Negative
Interorbital width	9.4-10.9	10.1	—
Length snout	5.7-7.4	6.5	—
Length anterior barbel	1.2-3.9	2.2	—
Length posterior barbel	3.3-7.8	5.5	—
Length pectoral fin	19.5-22.4	20.8	—
Length dorsal fin	28.4-31.6	29.5	—
Length caudal peduncle	19.3-24.0	21.0	—
Depth caudal peduncle	13.9-15.8	14.6	—

COLORATION: *in living specimens* brownish above, silvery on the flanks and whitish below. A dark mid-lateral band, often broken up into spots or streaks is present. No conspicuous colour was noted on the fins. *In formalin-fixed specimens*

each scale of the dorsal surface is marked with a broad band of fine melanophores, free from a narrow marginal zone and from the centre of each scale. These markings fade away quickly towards the flanks and a broad zone above the mid-lateral band is more or less pigment-free. The mid-lateral band consists of heavy pigment, approximately one third of a scale row in depth, originating at the level of the sixth or seventh lateral line scale and running along the horizontal myoseptum to the tip of the caudal peduncle. The band is frequently broken up into a series of rounded spots or streaks, connected by more lightly scattered pigment. Spots, when present, are irregular in arrangement and number; only the first, at the level of the sixth or seventh lateral line scale, and the last, on the tip of the caudal peduncle, are fixed in position. A few scattered melanophores lie on the horizontal myoseptum anterior to the mid-lateral band. Each pocket of the anterior lateral line scales may bear a small group of melanophores, divided horizontally into two by the lateral line pore. There are several indistinct spots of black pigment at the base of the anal fin. Relatively dense pigment is present on the posterior margin of the second simple dorsal ray and on the distal half of the third simple ray. Scattered melanophores are present on the distal parts of all branched dorsal rays.

DIAGNOSIS AND AFFINITIES: material identified as *B. nigeriensis* from the R. Katagum (Chad basin), Northern Nigeria in the British Museum (N.H.) reg. no. 1952.4.28.136-144, is now referred to *B. lawrae*. The Nigerian specimens differ from the types in having slightly fewer lateral line scales (28 to 31, mode 29 cf. 29 to 31, mode 30) but are in other respects identical.

Barbus lawrae most closely resembles *B. wernerii*, *sensu* Daget, 1954 (from the Middle Niger) but is more compressed laterally, has more lateral line scales (28 to 31, mode 29 and 30 cf. 25 to 29, mode 26 and 27) and much shorter barbels; in *B. lawrae* the anterior barbel barely extends beyond the base of the posterior barbel, whereas in *B. wernerii*, *sensu* Daget, the tip reaches the anterior margin of the pupil. Furthermore, a heavier and more pronounced spot marks the tip of the caudal peduncle in *B. wernerii*, *sensu* Daget.

During the present studies, specimens of *B. wernerii*, *sensu* Daget, 1954 from the Middle Niger (Paris Museum reg. no. 51-246) were compared with a syntype of *B. wernerii* Boulenger from Fashoda on the White Nile (Brit. Mus. (N.H.) reg. no. 1907.12.2.1333). They were found to be a distinct species. *Barbus wernerii* Boulenger is easily distinguishable from *B. wernerii*, *sensu* Daget, and from *B. lawrae* by the small terminal mouth, set very obliquely with the angle in front of the vertical to the nostril. In *B. wernerii*, *sensu* Daget, and in *B. lawrae* the mouth is subterminal and set more horizontally with the angle overlapping the vertical to the nostril. *Barbus wernerii* Boulenger is unusual in the form of the band of scattered melanophores on the line of the mid-lateral row of spots; the band veers upwards on the caudal peduncle to end slightly above the terminal spot. In *B. wernerii*, *sensu* Daget, and *B. lawrae* the band merges horizontally with the terminal spot.

Barbus lawrae closely resembles *B. lepidus* in form and pigment pattern. The mouth of *B. lepidus* is however more terminal, the barbels relatively longer and the body less compressed laterally. In *B. lepidus* the lateral line dips further below the

horizontal myoseptum and the two converge near the tip of the caudal peduncle (cf. the centre of the caudal peduncle in *B. lawrae*). The lateral spots of *B. lepidus*, although variable in number, are always rounded and discrete; spots present in *B. lawrae* are irregular and fragmented. The terminal spot in *B. lawrae* is never as pronounced as in *B. lepidus*.

Morphometrically, *B. lawrae* is also similar to *B. perince* with which it occurs in rivers of the Chad basin in Northern Nigeria (pers. record). *Barbus perince* is easily distinguished from *B. lawrae* by the three rounded, black, mid-lateral spots, one in the anterior third of the body, one below the last dorsal ray and one on the end of the caudal peduncle. *Barbus perince* also has longer barbels than *B. lawrae* (the anterior extending to the margin of the eye in *B. perince*) and the lateral line and horizontal myoseptum converge near the tip of the caudal peduncle (cf. the centre in *B. lawrae*).

DISTRIBUTION: in Ghana, probably rare and local; known only from the type locality in the Volta basin near Lawra. Elsewhere, rivers of the Chad basin in Northern Nigeria (pers. records).

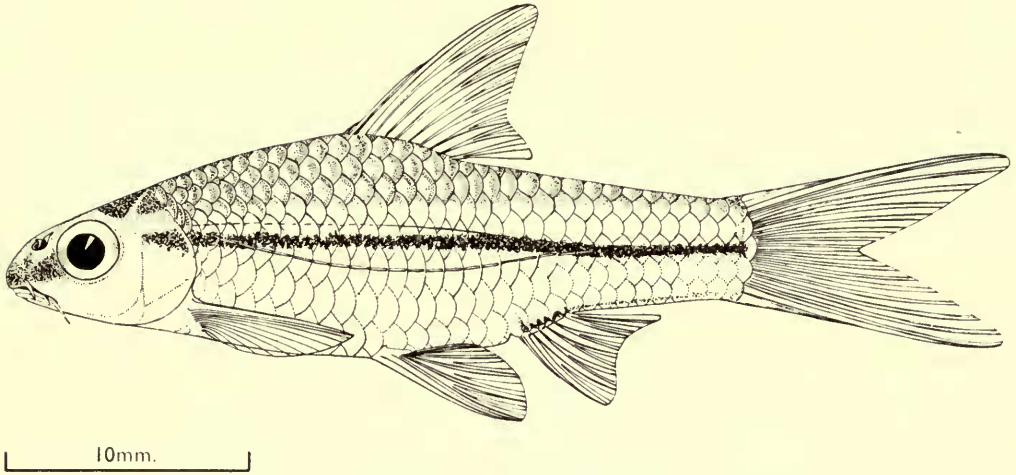
Barbus subinensis Hopson, 1965

(Text-fig. 8)

Barbus subinensis Hopson, 1965, *Rev. Zool. Bot. Afr.* 71: 249.

HOLOTYPE: a female of 33 mm. S.L. collected from the River Subin (Prah basin), Juaso, south Ghana, 9.xi.61, British Museum (N.H.) reg. no. 1964.9.8.256.

DESCRIPTION based on the holotype and 19 paratypes, 25–34 mm. S.L. from the River Subin, Juaso. Body somewhat compressed. S.L. 3.1 to 3.9 times the maximum depth and 3.4 to 4.1 times the length of the head. Predorsal profile smooth, convex, becoming abruptly steep on the snout. Snout 0.6 to 0.75 times the diameter of the eye. Mouth moderate, subterminal. Barbels small, the anterior 0.1 to 0.3 times and the posterior 0.2 to 0.4 times the diameter of the eye. The tip of the anterior barbel falls short of the base of the posterior barbel which extends posteriorly slightly beyond the vertical to the anterior margin of the pupil. Eyes lateral 2.65 to 3.05 times in the length of the head and 1.03 to 1.16 times in the interorbital width. Weakly-developed pit-lines are visible on the cheeks and operculum. Pectoral fin 0.7 to 0.85 times the length of the head, the tip overlapping the pelvic origin in three smaller individuals. Last simple dorsal ray smooth, flexible, 0.95 to 1.1 times the length of the head. Apex of dorsal fin somewhat pointed, distal margin slightly concave. Dorsal fin rays III 8; anal fin rays III 5. The pelvic origin lies on the vertical to the last simple dorsal ray. Caudal peduncle slender, 1.45 to 1.9 times as long as deep. The lateral line dips to a maximum depth of one and a quarter scale rows below the horizontal myoseptum in the anterior third of the body; the two converge in the anterior half of the caudal peduncle. Scales radially striated, 27 to 30 (modal number 28) in the lateral line. Five and a half scales between the lateral line and the dorsal origin, 4 to 4½ scales between the lateral line and the mid-ventral line immediately in front of the pelvic origin and 2½ between

FIG. 8. *Barbus subinensis*.

the lateral line and the pelvic origin. Nine (f.1), 10 (f.5), 11 (f.12) or 12 (f.2) scales round the caudal peduncle.

Summary of morphometric data based on 20 fish, 25 to 34 mm. S.L. ; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth	25.6-32.2	28.9	—
Length head	24.0-29.2	27.1	Negative
Diameter eye	8.5-10.4	9.4	—
Interorbital width	9.6-11.2	10.3	—
Length snout	5.9-7.4	6.4	—
Length anterior barbel	1.2-3.0	2.1	—
Length posterior barbel	2.0-3.9	3.0	—
Length pectoral fin	19.4-24.6	21.3	—
Length dorsal fin	25.0-30.0	27.0	—
Length caudal peduncle	21.0-25.0	22.5	—
Depth caudal peduncle	12.4-15.2	13.9	—

COLORATION : *in formalin-fixed specimens* a band of melanophores close to the margin of each scale forms a regular pattern over the dorsal surface of the body, fading abruptly on the flanks. A narrow continuous mid-lateral band of black pigment is always present. The band, which originates on the operculum runs below the myoseptum in the anterior half of the body ; the band and the myoseptum converge between the verticals to the last dorsal ray and the anal origin and run together onto the caudal peduncle. The ventral surface is pigment-free with the exception of a group of melanophores at the base of the anal fin which continues backwards as a narrow stripe along the ventral surface of the caudal peduncle. Snout with a conspicuous dark band running from eye to eye round the tip (cf. *B. punctitaeniatus*). Scattered melanophores noticeable on the anterior rays of the dorsal fin.

DISTRIBUTION : known only from the River Subin (Prah basin), near Juaso, south Ghana.

REMARKS : *Barbus subinensis* appears to have no close relatives. The lateral band and the markings on the snout recall *B. boboi* Schultz but the types of that species bear a large black spot on the caudal peduncle, have considerably longer barbels (anterior barbels 11.2–12.8 cf. 1.2–3.0% S.L. ; posterior barbels 11.8–13.0 cf. 2.0–3.9% S.L.) and only $4\frac{1}{2}$ scales above the lateral line compared with $5\frac{1}{2}$ in *B. subinensis*.

***Barbus trispilus* (Bleeker, 1863)**

(Text-fig. 9)

Puntius (Barbodes) trispilos Bleeker, 1863, *Nat. Verh. Wet. Haarlam*, 23 : 113, pl. 23, fig. 3.

Barbus trispilus : Boulenger, 1910, *Cat. Afr. Fish.* 2 : 163, fig. 141.

Barbus trispilus : Daget, 1952, *Mem. Inst. France. Afr. Noire*, no. 19 : 314, fig. 4.

DESCRIPTION based on 24 fish, 27–65 mm. S.L. from the River Weiwei (Prah Basin), Kumasi, south Ghana. Body slightly compressed. S.L. 3.0 to 3.75 times the maximum depth and 3.3 to 3.85 times the length of the head. Predorsal profile convex with a slight nuchal hump in larger individuals (over *c.* 40 mm. S.L.). Snout rounded, 0.65 to 0.9 times the diameter of the eye. Mouth moderate, subterminal. Barbels relatively long, the anterior 1.05 to 1.55 times the diameter of the eye, the tip usually extending beyond the vertical to the posterior margin of the eye. Posterior barbel 1.5 to 1.8 times the diameter of the eye, the tip extending beyond the posterior margin of the preoperculum. Eyes inclined slightly upwards, the diameter 2.9 to 3.6 times in the length of the head and 1.15 to 1.65 times in the interorbital width. Weakly-developed pit-lines present on the cheek and operculum. Pectoral fin 0.6 to 0.85 times the length of the head, the tip falling short of the pelvic origin. Last simple dorsal ray smooth, flexible, 0.75 to 0.95 times the length of the head. Apex of dorsal fin slightly rounded, distal margin concave. Dorsal fin rays III 8. Anal

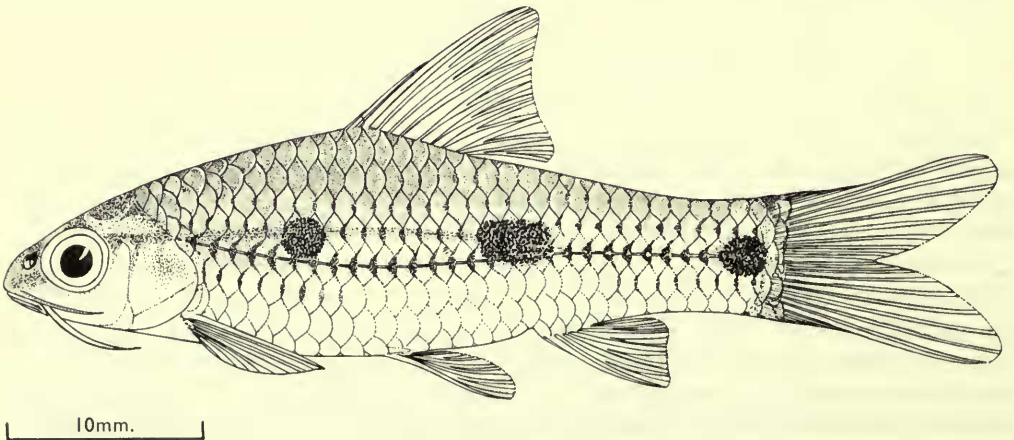


FIG. 9. *Barbus trispilus*.

fin rays III 5. The pelvic origin lies between the verticals to the last simple and first branched dorsal rays. Caudal peduncle 1.2 to 1.5 times as long as deep. The lateral line dips to a maximum of the depth of slightly over a scale row below the horizontal myoseptum in the anterior third of the body; the two converge in the first third of the caudal peduncle. Lateral line scales 26 to 29 (modal number 28). Four and a half scales between the lateral line and the dorsal origin, $4\frac{1}{2}$ to $5\frac{1}{2}$ scales between the lateral line and the mid-ventral line, immediately in front of the pelvic origin and $2\frac{1}{2}$ scales between the lateral line and the pelvic origin. Twelve scales round the caudal peduncle.

Summary of morphometric data based on 24 fish, 27 to 65 mm. S.L.; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth	26.2-32.9	29.3	—
Length head	25.8-30.0	27.7	Negative
Diameter eye	7.4-10.0	8.8	Negative
Interorbital width	10.2-12.0	10.8	—
Length snout	5.6-7.4	6.6	—
Length anterior barbel	9.8-12.7	11.1	—
Length posterior barbel	11.7-15.4	13.8	—
Length pectoral fin	18.5-23.4	20.5	—
Length dorsal fin	20.4-26.4	24.1	—
Length caudal peduncle	17.4-22.6	20.0	—
Depth caudal peduncle	13.6-15.6	14.8	—

COLORATION: *in formalin-fixed specimens*, dorsal surface with a dense peppering of fine melanophores, more scattered towards the centre and free from a narrow zone near the margin of each scale. The lateral line scale pockets are each marked with a small, dark, triangular patch bisected horizontally by the lateral line pore. Similar but lighter markings are present on most scale rows above the lateral line and on the anterior and posterior scales of the row below. Three round, black, mid-lateral spots are always present, the first at the level of the sixth or seventh lateral line scale, the second immediately behind the vertical to the last dorsal ray and the third on the tip of the caudal peduncle. The second spot is slightly larger than the first and last spots which are approximately the depth of a scale row in diameter. Slight elongation of the second and third spots was noted in a few specimens. Scattered melanophores form a faint band over the horizontal myoseptum between the spots. The base of the anal fin is marked with a few indistinct melanophores.

DIAGNOSIS: these data are in close agreement with previous descriptions of the species. *Barbus trispilus* is superficially similar to *B. perince* (from the Nile and Chad basins) which is also marked with three round mid-lateral spots. *Barbus trispilus* has, however, fewer lateral line scales (26-29 cf. 28-32 in *B. perince*), a lateral line which dips less markedly below the horizontal myoseptum (1 cf. $1\frac{1}{2}$ scale rows) and relatively longer barbels (the anterior reaching the posterior margin of the eye cf. the anterior margin in *B. perince*). The lateral spots are relatively larger in *B. trispilus*.

DISTRIBUTION : *in Ghana*, widespread and common in forest streams and rivers (notably the Prah basin) in the south-west. Probably absent from the Volta. *Elsewhere* Dabo Crom, Guinea (type locality); Sierra Leone (Norman, 1932); Bolor River, Liberia (Schultz, 1942); Mt. Nimba, Rep. Guinea (Daget, 1952).

***Barbus sublineatus* Daget, 1954**

(Text-fig. 10)

Barbus sublineatus Daget, 1954, *Mem. Inst. France. Afr. Noire*, no. 36 : 203, fig. 69.

Barbus sublineatus : Blanc & Daget, 1957, *Mem. Inst. France. Afr. Noire*, no. 50 : 137, figs. 15 and 16.

DESCRIPTION based on 24 fish 28–40 mm. S.L. from a tributary of the White Volta, 5 miles north of Bawku, north Ghana. Body slightly compressed. S.L. 3.8 to 4.4 times the maximum depth and 3.4 to 3.85 times the length of the head. Predorsal profile convex with a slight nuchal hump. Snout rather pointed 0.6 to 0.8 times as long as the diameter of the eye. Mouth moderate, sub-terminal. Barbels relatively long, the anterior 0.5 to 0.95 and the posterior 0.75 to 1.12 times the diameter of the eye. The tip of the anterior barbel normally extends beyond the centre and the posterior barbel beyond the posterior margin of the eye. Eyes inclined slightly upwards, relatively large, 2.65 to 3.1 times in the length of the head and 1.03 to 1.17 times in the interorbital width. Weakly-developed pit-lines are present on the cheek and operculum. Pectoral fin 0.65 to 0.75 times the length of the head, the tip falling short of the pelvic origin. Last simple dorsal ray smooth, flexible, 0.75 to 0.95 times as long as the head. Apex of dorsal fin slightly rounded, distal margin concave. Dorsal fin rays III 8; anal fin rays III 5. The origin of the pelvic fin lies between the verticals to the first and second branched dorsal rays. Caudal peduncle 1.35 to 1.7 times as long as deep. The lateral line dips to a maximum

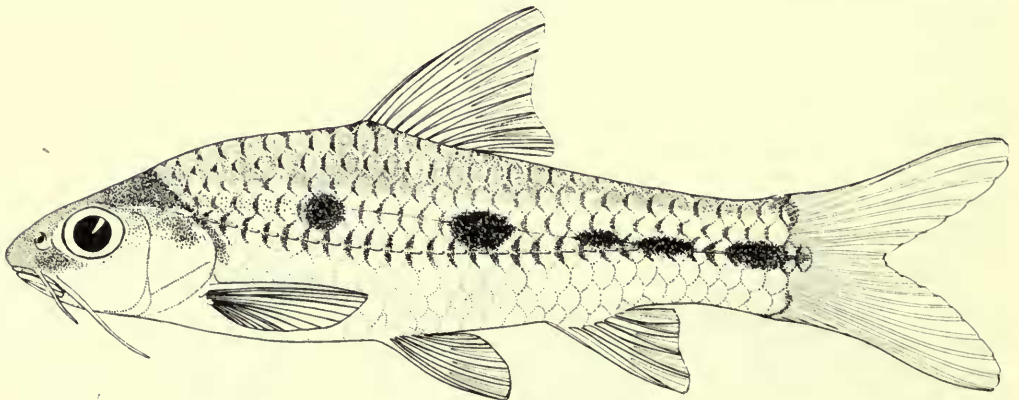


FIG. 10. *Barbus sublineatus*.

of approximately the depth of one scale row below the horizontal myoseptum in the anterior third of the body; the two converge in the vertical to the posterior anal rays or in the anterior third of the caudal peduncle. Lateral line scales 27 to 31 (modal number 29). Four and a half scales between the lateral line and the dorsal origin, $4\frac{1}{2}$ scales between the lateral line and the mid-ventral line immediately in front of the pelvic origin and $2\frac{1}{2}$ scales between the lateral line and the pelvic origin. Twelve scales round the caudal peduncle.

Summary of morphometric data based on 24 fish, 28 to 40 mm. S.L.; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth	22.5-26.3	24.5	—
Length head	25.8-29.2	27.4	—
Diameter eye	8.7-10.3	9.5	Negative
Interorbital width	9.7-11.5	10.5	—
Length snout	5.8-7.0	6.5	—
Length anterior barbel	5.3-9.1	7.3	—
Length posterior barbel	7.8-11.2	9.2	—
Length pectoral fin	18.7-20.3	19.5	—
Length dorsal fin	22.5-25.3	23.9	—
Length caudal peduncle	19.0-22.4	20.7	—
Depth caudal peduncle	12.0-14.3	13.8	—

COLORATION: *in living specimens*, yellowish fawn above, flanks silvery, belly whitish, the body marked laterally with a row of four or more dark spots. Rays of caudal fin with pale pink chromatophores, yellowish nearer the base; dorsal and pectoral rays with pale yellowish chromatophores; pelvic and anal fins clear. The iris is marked dorsally with an orange-red crescent. *In formalin-fixed specimens* dorsal surface finely peppered with melanophores free from the margin and thinning out towards the centre of each scale; the pattern fades out on more lateral rows. A basic series of four black rounded spots lies over the horizontal myoseptum, the first at the level of the seventh lateral line scale, the second below the last dorsal ray, the third starting above the last anal ray and the fourth on the tip of the caudal peduncle. The last three are usually slightly elongated. Additional spots up to four in number may occur, usually between the second and the fourth spot. Occasionally two or more of the posterior spots may coalesce to form a band. Each lateral line scale is marked on the pocket with a small compact group of melanophores. Similar pigment though less heavy is present on scales above the lateral line. The ventral surface is generally pigment-free with the exception of a faint dark spot at the base of the anal fin continuing backwards as a slender line along the ventral surface of the caudal peduncle.

DIAGNOSIS AND AFFINITIES: Blanc & Daget (1959) note variation in the pigmentation of *B. sublineatus*. Type specimens from the Middle Niger are marked with a dark continuous mid-lateral band. The band is represented in more recent material from the Volta and from the Haute Comoé (Blanc & Daget, 1957) by a series of spots comparable with the markings of the present material from Ghana. In other

respects our data agree closely (with allowances for allometry) with the type description. *Barbus sublineatus* is closely related to *B. lineomaculatus* Blgr. which occurs in East and South Africa. *Barbus lineomaculatus* is similarly marked with a series of lateral spots but never as few as four. In this species most of the first spot lies above the horizontal myoseptum whereas in *B. sublineatus* it is situated chiefly below. *Barbus sublineatus* also has relatively larger eyes, a narrower interorbital space and the dorsal fin is inserted more posteriorly.

HABITAT AND DISTRIBUTION: *in Ghana*, widespread in the north, *B. sublineatus* occurs sparingly in most of the rivers and larger streams over a substrate of gravel or sand. It is apparently absent from lagoons, pools and dams. *Elsewhere*, recorded from the Haute Comoé (Blanc & Daget, 1957) and the Middle Niger (Daget, 1954).

LIFE HISTORY: the occurrence of ripe females in June indicates that, as in other *Barbus*, spawning takes place during the rainy season. Females grow larger than males. Maximum size—a female of 74 mm. S.L.

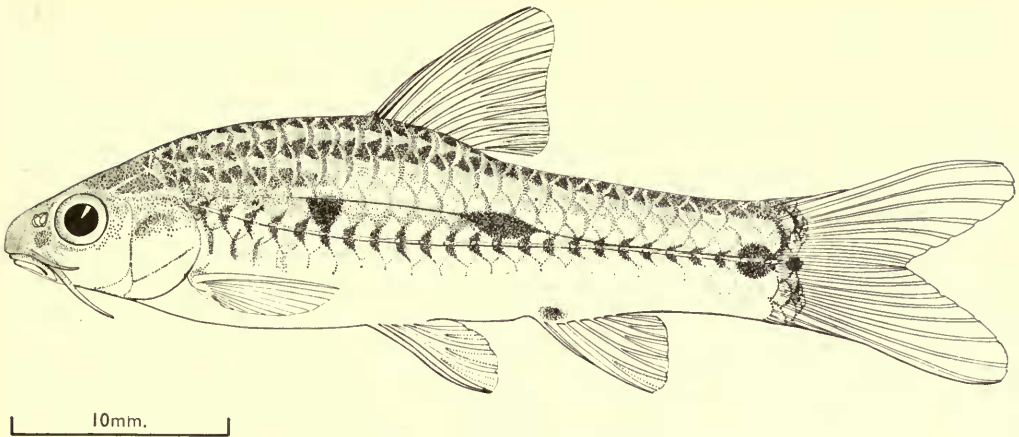
Barbus macinensis Daget, 1954

(Text-fig. 11)

Barbus macinensis Daget, 1954, *Mem. Inst. France. Afr. Noire*, no 36 : 200, fig. 67.

Barbus macinensis : Blanc & Daget, 1957, *Mem. Inst. France. Afr. Noire*, no. 50 : 137.

DESCRIPTION based on 25 fish 26–32 mm. S.L. from the River Nahau, 5 miles north of Bawku, northern Ghana. Body slightly compressed. S.L. 3.75 to 4.6 times the maximum depth and 3.55 to 4.05 times the length of the head. Predorsal profile well humped; snout rounded, 0.65 to 0.8 times the diameter of the eye. Mouth moderate, subterminal. Anterior barbel 0.65 to 0.8 times the diameter of the eye, its tip reaching the vertical to the anterior half of the pupil. Posterior barbel 0.8 to 1.2 times the diameter of the eye, the tip usually extending beyond the vertical to the posterior margin. Eyes inclined slightly upwards, diameter 2.85 to 3.55 times in the length of the head and 1.2 to 1.35 times in the interorbital width. Head with weakly-developed pit-lines on the cheek and operculum. Pectoral fin 0.65 to 0.8 times the length of the head, its tip falling short of the pelvic origin. Last simple dorsal ray smooth, flexible, 0.8 to 1.0 times as long as the head. Apex of dorsal fin rounded, distal margin barely concave. Dorsal fin rays III 8; anal fin rays III 5. The origin of the pelvic fin lies between the vertical to the 1st and 2nd simple rays. Caudal peduncle rather stout, 1.15 to 1.5 times as long as deep. The lateral line dips to a maximum of slightly less than a scale row's depth below the horizontal myoseptum in the anterior third of the body. The two converge in the anterior half of the caudal peduncle. Lateral line scales 24 to 27 (modal numbers 25 and 26). Three and a half scales between the lateral line and the dorsal origin, $4\frac{1}{2}$ scales between the lateral line and the mid-ventral line immediately in front of the pelvic origin and $2\frac{1}{2}$ scales between the lateral line and the pelvic origin. Ten (f.1), 11 (f.15) or 12 (f.9) scales round the caudal peduncle.

FIG. II. *Barbus macinensis*.

Summary of morphometric data based on 25 fish, 26 to 32 mm. S.L. ; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth . . . . .	. 24.7-27.8	26.2	—
Length head . . . . .	. 21.4-26.6	24.6	—
Diameter eye . . . . .	. 7.8-9.2	8.4	Negative
Interorbital width . . . . .	. 10.3-11.8	10.9	Negative
Length snout . . . . .	. 5.7-6.7	6.2	—
Length anterior barbel . . . . .	. 3.5-5.9	4.9	—
Length posterior barbel . . . . .	. 6.8-10.3	8.4	—
Length pectoral fin . . . . .	. 17.9-22.9	19.9	—
Length dorsal fin . . . . .	. 22.4-26.3	24.3	—
Length caudal peduncle . . . . .	. 18.2-21.8	20.2	—
Depth caudal peduncle . . . . .	. 14.4-15.9	15.1	—

COLORATION : *in living specimens*, dark brownish-yellow above, silvery on the sides, pearly white below. Body marked dorsolaterally with three dark longitudinal stripes. Three lateral spots are present and the lateral line bears a series of small black dots. Basal two-thirds of the caudal fin, the dorsal, pectoral and pelvic fins pale straw-yellow. Distal third of the caudal and the anal fin clear. The iris is marked dorsally with an orange-red crescent. *In formalin-fixed specimens* body marked dorsolaterally on each side with three dark bands running along the overlapping portion of adjacent scale rows and formed by a concentration of melanophores in the upper and lower third of each scale. The two upper bands extend along the entire length of their respective scale rows but the lowest, lying between the first and second rows of scales above the lateral line, ends in front of the vertical to the dorsal fin. The lowest band is frequently ill-defined and sometimes absent. One or two round dark spots are often present on the dorsal mid-line between the head and dorsal fin. Each scale of the lateral line, including the two overlapping the base of the caudal fin, is marked with a small but heavy concentration of melanophores, usually divided horizontally into two by the lateral line pore. Three conspicuous black spots

are constantly present on the horizontal myoseptum, the first at the level of the 7th lateral line scale, the second below the last dorsal fin ray and the third at the tip of the caudal peduncle. The second spot is somewhat elongated. Faint melanophores occasionally form a noticeable band between the second and the last spots. Scales of the row below the lateral line are often outlined with fine pigment and there is always a faint subepidermal group of melanophores at the base of the anal fin. The remainder of the ventral surface is pigment-free.

DIAGNOSIS AND AFFINITIES: stumpy and thick-set in appearance, *B. macinensis* should be easily distinguishable from other voltaic species by the characteristic pattern of pigmentation. Our data are in close accordance with the original description (Daget, 1954) based on specimens from the Middle Niger. *Barbus macinensis* has close affinities with the morphometrically similar *B. niokoloensis* Daget, 1959 from the Gambia River, which is also marked longitudinally with dark dorsolateral bands. That species, however, lacks the three lateral spots of *B. macinensis* and the lateral line scales bear a dark stripe, extending forward onto the operculum.

Barbus macinensis is superficially similar to *B. neefi* Greenwood (1962) from the Upper Zambesi which is also marked with dorsolateral stripes and lateral spots. *Barbus neefi*, however, has more than three spots and in addition, horizontal stripes below the lateral line. Compared with *B. neefi*, *B. macinensis* has fewer scales between the lateral line and the dorsal origin ($3\frac{1}{2}$ cf. $4\frac{1}{2}$ – $5\frac{1}{2}$), shorter barbels (anterior 3.5–5.9 cf. 6.0–10.3% S.L.; posterior 6.8–10.3 cf. 10.0–14.8% S.L. in *B. neefi*) and a stouter caudal peduncle.

A comparison is made between *B. macinensis* and *B. voltae* in the description of that species.

HABITAT AND DISTRIBUTION: in Ghana, *B. macinensis* is present in suitable localities throughout the northern regions. The distribution suggests a preference for coarse substrates and the species is particularly abundant in the sandy pools of dry season river beds. Dams are sometimes colonized if there is a sandy or gravelly bottom but the species is generally absent over muddy substrates and from areas of thick vegetation. Elsewhere, recorded from the Haute Comoé (Blanc & Daget, 1957) and from the Middle Niger (type locality). Blanc & Daget (*op. cit.*) note this species in the Volta basin, Haute Volta.

LIFE HISTORY: *Barbus macinensis* breeds during the rainy season. Ripe and ripening females were observed between May and August and the first juvenile stages appeared in the rivers during July. Growth seems to be more rapid in females than in males. All fish ripen at the end of their first year and few if any survive to spawn a second time. Maximum size, a female of 5.9 cm. S.L.

Barbus voltae Hopson, 1965

(Text-fig. 12)

Barbus voltae Hopson, 1965, *Rev. Zool. Bot. Afr.* 71: 251

Barbus nigriensis: Blanc & Daget, 1957, *Mem. Inst. France. Afr. Noire*, no. 50: 135, fig. 14.

HOLOTYPE: a female of 31 mm. S.L. from the River Nahau (tributary of the

White Volta), 5 miles north of Bawku, northern Ghana, 27.xi.61, British Museum (N.H.) reg. no. 1964.9.8.73.

DESCRIPTION based on the holotype and 23 paratypes, 27 to 33 mm. S.L. from the River Nahau, near Bawku. Unfortunately we have been unable to examine the material identified by Blanc and Daget (*op. cit.*) as *B. nigeriensis*. Body somewhat compressed. S.L. 3.3 to 3.7 times the maximum depth and 3.25 to 3.7 times the length of the head. Predorsal profile smooth, convex. Snout bluntly pointed, 0.55 to 0.7 times the diameter of the eye. Mouth small, subterminal, protrusible and opening obliquely downwards. Anterior barbel 0.1 to 0.25 times the diameter of the eye, the tip falling short of the base of the posterior barbel. Posterior barbel 0.15 to 0.4 times the diameter of the eye, the tip extending to between the verticals to the anterior margin of the eye and the anterior margin of the pupil. Eyes lateral, 3.35 to 3.7 times in the length of the head and 1.0 to 1.25 times in the interorbital width. Weakly-developed pit-lines present on the cheek and operculum. Pectoral fin 0.55 to 0.8 times the length of the head, the tip falling short of the pelvic origin. Last simple dorsal ray, smooth, flexible, 0.9 to 1.05 times as long as the head. Apex of dorsal fin slightly rounded, distal margin concave. Dorsal fin rays III 7 (f.1) or III 8 (f.23). Anal fin rays III 5. The origin of the pelvic fin lies in the vertical to the first branched dorsal ray. Caudal peduncle 1.35 to 1.55 times as long as deep. The lateral line dips to a maximum of slightly less than the depth of a scale row below the horizontal myoseptum in the anterior third of the body; the two converge in the anterior third of the caudal peduncle. Scales radially striated, 25 to 29 (modal number 27) in the lateral line. Three and a half scales between the lateral line and the dorsal origin, $3\frac{1}{2}$ scales between the lateral line and the mid-ventral line immediately in front of the pelvic origin, and 2 to $2\frac{1}{2}$ scales between the lateral line and the pelvic origin. Eleven (f.1) or 12 (f.23) scales round the caudal peduncle.

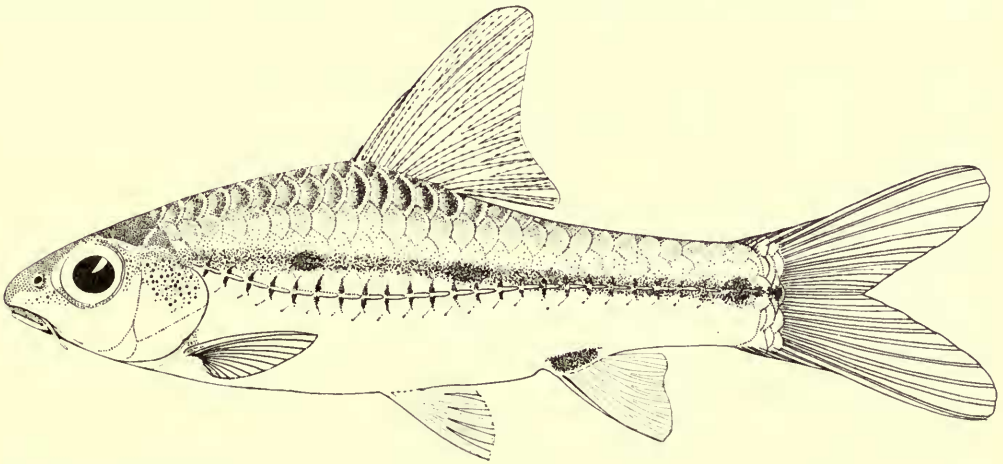


FIG. 12. *Barbus voltae*.

Summary of morphometric data based on 24 fish, 27 to 33 mm. S.L. ; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth	26.8-29.6	27.8	—
Length head	26.7-30.6	28.2	Negative
Diameter eye	9.4-11.1	10.0	Negative
Interorbital width	9.6-12.9	11.2	—
Length snout	5.8-7.3	6.4	—
Length anterior barbel	1.0-2.6	1.8	—
Length posterior barbel	1.6-3.7	2.6	—
Length pectoral fin	16.5-22.5	19.8	—
Length dorsal fin	25.3-31.1	27.7	—
Length caudal peduncle	20.0-25.0	21.5	—
Depth caudal peduncle	13.6-15.5	14.5	—

COLORATION : *in living specimens* brownish above, brilliant silver on the flanks, whitish below. The body is marked mid-laterally with three small black spots ; a fourth spot is present at the base of the anal fin. Caudal fin sandy-fawn, dorsal fin pinkish-fawn, base of pectoral fin rays pale yellow. The remaining fins are colourless. Iris, red above. *In formalin-fixed specimens* the dorsal surface is peppered with fine melanophores, free from the centre and margin of each scale. The pigment is heaviest on the scales at the base of the dorsal fin and fades away on the second row of scales above the lateral line. A moderately heavy band of melanophores, approximately half a scale row in depth, runs along the horizontal myoseptum from the operculum to end in a small, round, black spot on the tip of the caudal peduncle. Two other mid-lateral spots are always present. They are small, usually slightly elongated and lie within the lateral band, the first at the level of the sixth or seventh lateral line scale and the second below the last dorsal fin ray. Although the band varies in intensity and is sometimes broken into a series of irregular streaks, the three spots are always discernible. Each lateral line scale is marked on the pocket with a small but conspicuous group of melanophores, bisected horizontally by the lateral line pore. Similar but lighter markings often appear on the first and second row of scales above the lateral line. A conspicuous black spot is always present on the body at the base of the anal fin.

DIAGNOSIS AND AFFINITIES : *Barbus voltae* is the species described by Blanc & Daget (1957) as *B. nigeriensis*. *Barbus voltae* differs from *B. nigeriensis* Boulenger in a number of important details : fewer scales between the lateral line and the dorsal origin ($3\frac{1}{2}$ cf. $4\frac{1}{2}$ in *B. nigeriensis*), considerably shorter barbels (anterior 1.0-2.6 cf. 6.4-10.0% S.L. ; posterior 1.6-3.7 cf. 7.8-12.0% S.L. in *B. nigeriensis*), smaller eyes and a much smaller mouth. Furthermore, *B. nigeriensis* Blgr. has no trace of lateral spots which are always present in *B. voltae*.

Barbus voltae is superficially similar to *B. macinensis* with which it frequently occurs in the Volta basin. It is, however, easily distinguished by the smooth predorsal profile (humped in *B. macinensis*), shorter barbels (anterior 1.0-2.6 cf. 3.5-5.9% S.L. ; posterior 1.6-3.7 cf. 6.8-10.3% S.L.), a smaller mouth, larger eyes

(9.4-11.1 cf. 7.8-9.2% S.L. in *B. macinensis*) and a more obvious spot at the base of the anal fin. *Barbus voltae* also lacks the dorsolateral stripes of *B. macinensis*.

HABITAT AND DISTRIBUTION: in Ghana, common in rivers, streams and dams throughout the northern regions. Infrequent in well-vegetated situations. *Barbus voltae* is more plentiful over muddy than over sandy bottoms, indicating a preference for finer substrates. Elsewhere, recorded only from the Black Volta and its tributaries in Haute Volta (Blanc & Daget, 1957).

***Barbus atakorensis* Blanc & Daget, 1957**

(Text-fig. 13)

Barbus atakorensis Blanc & Daget, 1957, *Mem. Inst. France. Afr. Noire*, no. 50 : 140, fig. 17.

DESCRIPTION based on 21 fish 27-36 mm. S.L., from Dahwenia Dam, 6 miles east of Tema, south Ghana. Body moderately compressed. S.L. 3.3 to 3.9 times the maximum depth and 3.5 to 4.0 times the length of the head. Predorsal profile convex with a slight nuchal hump. Snout somewhat pointed, 0.7 to 0.95 times as long as the eye diameter. Mouth moderate, subterminal. Anterior barbel 0.25 to 0.5 times the diameter of the eye, the tip extending beyond the base of the posterior barbel. Posterior barbel 0.6 to 0.95 times the diameter of the eye, the tip extending to between the verticals to the posterior margin of the pupil and the posterior margin of the eye. Eyes lateral, the diameter 3.2 to 3.6 times in the length of the head and 1.2 to 1.5 times in the interorbital width. Weakly-developed pit-lines visible on the cheeks and operculum. Pectoral fin 0.6 to 0.8 times as long as the head, the tip falling short of the pelvic origin. Last simple dorsal ray smooth, flexible, 0.8 to 0.95 times the length of the head. Apex of dorsal fin rounded, distal margin slightly concave. Dorsal fin rays III 7. Anal fin rays III 5. The origin of the pelvic fin

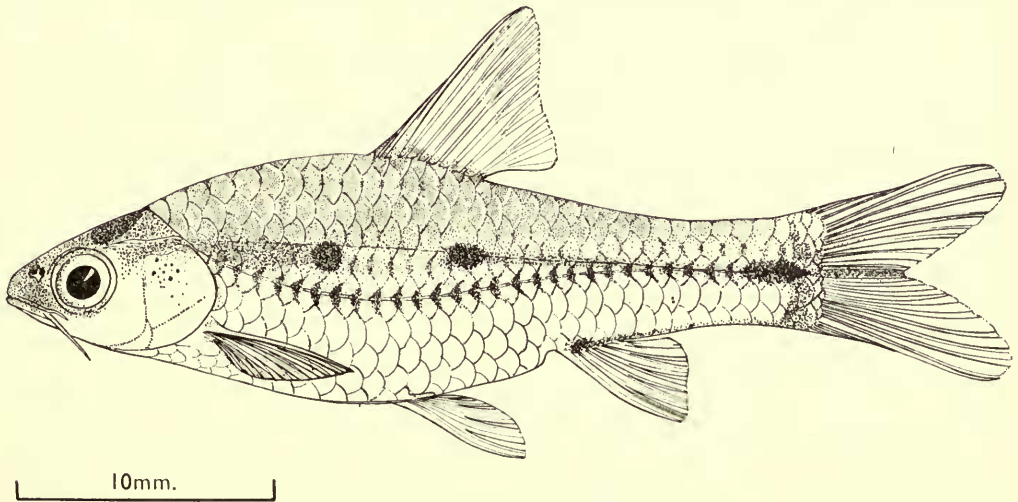


FIG. 13. *Barbus atakorensis*.

lies between the vertical to the first and second branched dorsal rays. Caudal peduncle relatively slender, 1.4 to 1.8 times as long as deep. The lateral line dips to a maximum of the depth of one and a half rows below the horizontal myoseptum in the anterior third of the body; the two converge in the anterior third of the caudal peduncle. Lateral line scales 27 to 32 (modal number 28). Four and a half to $5\frac{1}{2}$ scales between the lateral line and the dorsal origin, $4\frac{1}{2}$ to $5\frac{1}{2}$ scales between the lateral line and the mid-ventral line immediately in front of the pelvic origin, and $2\frac{1}{2}$ to 3 scales between the lateral line and the pelvic origin; 12 scales round the caudal peduncle.

Summary of morphometric data based on 21 fish, 27 to 36 mm. S.L.; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth	26.5-30.5	28.2	—
Length head	24.9-27.5	26.0	Negative
Diameter eye	6.9-8.5	7.5	Negative
Interorbital width	9.7-10.9	10.3	—
Length snout	5.4-6.7	6.2	—
Length anterior barbel	2.1-3.3	2.7	—
Length posterior barbel	5.0-6.8	5.7	—
Length pectoral fin	17.8-20.4	19.3	—
Length dorsal fin	20.9-24.5	23.3	—
Length caudal peduncle	20.9-24.0	21.8	—
Depth caudal peduncle	13.2-15.0	14.1	—

COLORATION: *in living specimens* body greyish green, dark above, paler on the sides and whitish on the belly. Fins colourless. The colour pattern is best seen in *formalin-fixed specimens* where the dorsal surface is peppered with fine melanophores, less heavy in the centre of each scale and absent from the free margin. The pigmentation becomes lighter on the flanks and fades out on the second row of scales above the lateral line. Pockets of each lateral line scale are marked with a small group of dense melanophores split horizontally into two by the lateral line pore. Similar markings are repeated on the pockets of the first and sometimes the second row of scales above the lateral line. The horizontal myoseptum, appearing as a fine black line, is punctuated in most specimens with three black spots, the first at the level of the 7th lateral line scale, the second on the vertical to the last dorsal ray and the third at the tip of the caudal peduncle, partly overlapping the base of the caudal fin. The third spot, present in all specimens, is elongated and nearly twice as long as deep. The other two spots are variable in size and shape and one or both may be missing. Occasionally a fourth spot may occur immediately behind the vertical to the last anal ray. Scattered melanophores, usually heavier in the posterior half of the body, lie in a diffuse band over the horizontal myoseptum. Underparts unpigmented with the exception of a faint black spot at the base of the anal fin and a thin dark line along the ventral surface of the caudal peduncle.

DIAGNOSIS AND AFFINITIES: these data agree closely with the original description (Blanc & Daget, 1957) of material from the Volta basin in north Dahomey. We

found $5\frac{1}{2}$ as well as $4\frac{1}{2}$ scale rows below the lateral line and a higher maximum number of lateral line scales (32 cf. 29) although the modal number, 28, was the same. The two collections differ principally in coloration. Whereas our specimens normally have three lateral spots, the type material is characterized by a dark mid-lateral band, continuous from the operculum to the caudal peduncle. We noted, however, that in the Paris Museum paratypes the band is constricted on the caudal peduncle to form a rectangular terminal spot identical with the spot of our own specimens. Although *B. atakorensis* is superficially similar to numerous species of *Barbus* each with three lateral spots, we consider that it has no near relatives. The presence of only seven branched dorsal rays, the relatively high number of scales and the elongated spot on the slender caudal peduncle should prevent confusion with other species.

DISTRIBUTION : *in Ghana*, at present known only from dams on the Accra plains and from the River Azubone (Volta basin) in forest country near Mpraeso. The dams are on small coastal rivers draining directly into the sea. No specimens of *B. atakorensis* were collected in the northern regions of the country. *Elsewhere*, the upper reaches of the River Oti (Volta basin), in north Dahomey (type locality), the Ogun River, south-west Nigeria (personal observation), and the Kaduna River (Niger Basin), Northern Nigeria (B.M. (N.H.) reg. no. 1936. 11.24.27-29).

Barbus punctitaeniatus Daget, 1954

(Text-fig. 14)

Barbus punctitaeniatus Daget, 1954, *Mem. Inst. France. Afr. Noire*, no. 36 : 202, fig. 68.

Barbus punctitaeniatus : Blanc & Daget, 1957, *Mem. Inst. France. Afr. Noire*, no. 50 : 137.

DESCRIPTION based on 24 specimens 21-37 mm. S.L., 8 from tributaries of the White Volta near Bawku and 16 from the Black Volta near Lawra, northern Ghana. Body moderately compressed. S.L. 3.55 to 4.3 times the maximum depth and 3.55 to 4.1 times the length of the head. Predorsal profile convex with slight nuchal hump, more pronounced in the largest individuals. Snout bluntly pointed, 0.55 to 0.9 times the diameter of the eye. Mouth moderate, subterminal. Barbels relatively long, the anterior 0.4 to 0.85 times and the posterior 0.8 to 1.2 times the diameter of the eye. Tip of the anterior barbel extending to about the vertical to the centre of the eye and the posterior barbel extending beyond the posterior margin. Eyes lateral, 2.75 to 3.6 times in the length of the head and 1.0 to 1.35 times in the interorbital width. Cheeks and operculum with weakly-developed pit-lines. Pectoral fin 0.65 to 0.85 times the length of the head, the tip falling short of the pelvic origin. Last simple dorsal ray smooth, flexible, 0.8 to 1.0 times as long as the head. Apex of dorsal fin slightly rounded, distal margin concave. Dorsal fin rays III 7 (f.1) or III 8 (f.23). Anal fin rays III 5. The pelvic origin lies on the vertical to the first branched dorsal ray. Caudal peduncle 1.35 to 1.85 times as long as deep. The lateral line incomplete in all but the three largest specimens (28-37 mm S.L.) with 7 to 12 anterior scales perforated; total scales in the row 23 to 27 (modal number 25); this row dips to a maximum of slightly more than the depth of

half a scale row below the horizontal myoseptum in the anterior third of the body; the two converge at the anterior end of the caudal peduncle. Three and a half scales between the lateral line and the dorsal origin, $3\frac{1}{2}$ scales between the lateral line and the mid-ventral line immediately in front of the pelvic origin and $2-2\frac{1}{2}$ scales between the lateral line and the pelvic origin. Nine (f.22) or 10 (f.2) scales round the caudal peduncle.

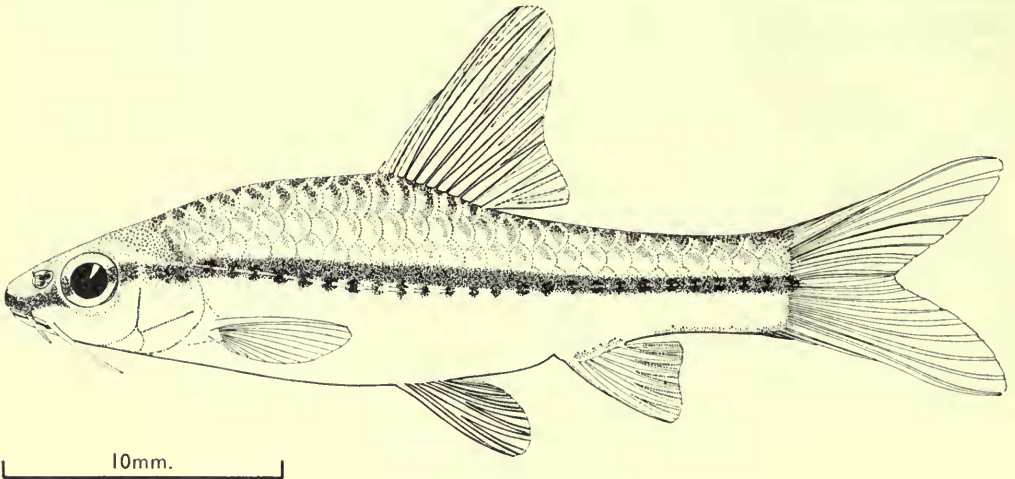


FIG. 14. *Barbus punctitaeniatus*.

Summary of morphometric data based on 24 fish, 21–37 mm. S.L.; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth . . .	23.1–28.1	25.5	—
Length head . . .	24.2–28.0	26.3	Negative
Diameter eye . . .	7.1–10.0	8.7	Negative
Interorbital width . . .	8.3–11.0	9.8	—
Length snout . . .	5.0–6.5	6.0	—
Length anterior barbel . . .	3.2–6.4	4.6	—
Length posterior barbel . . .	6.0–11.2	8.8	—
Length pectoral fin . . .	18.2–24.2	19.7	—
Length dorsal fin . . .	22.0–25.9	24.4	—
Length caudal peduncle . . .	18.8–23.6	21.3	—
Depth caudal peduncle . . .	12.1–15.0	13.4	—

COLORATION: *in living specimens* dorsal surface light fawn, silvery on the sides, whitish below. A narrow, dark mid-lateral band runs from the tip of the snout to the tip of the caudal peduncle. Yellow chromatophores are scattered over the dorsal surface, on the operculum and most noticeably in a narrow zone above the lateral band. Pectoral fins frequently tinged with yellow; all other fins colourless. The iris is marked dorsally with a yellow crescent. *In formalin-fixed specimens* pigment on the dorsal surface consists of a relatively slender band of dense melanophores near the margin of each scale fading abruptly on the flanks. A narrow black stripe

originating on the tip of the snout (i.e. continuous round the tip from eye to eye) runs obliquely upwards across the operculum and thence along the body. The stripe lies slightly below the horizontal myoseptum in the anterior half of the body but the two converge on the caudal peduncle. The stripe is intensified by small round spots of dense pigment on the pockets of all lateral line scales. Melanophores form a faint stripe at the base of the anal fin continuing backwards as a narrow line along the ventral surface of the caudal peduncle.

DIAGNOSIS: our data are in close agreement with the type description (Daget, 1954) based on specimens from the Middle Niger. We examined six of the syntypes in the Paris Museum and found that as in most of the material from Ghana, the lateral line is incomplete, a point which Daget did not observe.

Barbus punctitaeniatus is readily distinguished from most West African species by the black streak on the snout running without interruption round the tip. *Barbus boboi* and *B. subinensis* are similarly marked but both have higher scale counts and a pronounced dip in the lateral line; in *B. punctitaeniatus* the dip is unusually shallow. The differences between this species and *B. bawkuensis* are discussed in the description of that species below.

DISTRIBUTION: in Ghana, widespread and reasonably common in the northern regions, usually in rivers but occasionally in dams. Elsewhere, the Middle Niger (Daget, 1954), the Volta basin in Haute Volta (Blanc & Daget, 1957) and rivers of the Chad basin in Northern Nigeria (personal records).

LIFE HISTORY: the spawning season is probably restricted to the rains. Ripe females were noted in July and juveniles appeared in the rivers during September. Females grow larger than males. Maximum size 37 mm. S.L.

Barbus bawkuensis Hopson, 1965

(Text-fig. 15)

Barbus bawkuensis Hopson, 1965, *Rev. Zool. Bot. Afr.* **71**: 254

HOLOTYPE: a female of 26 mm. S.L. from the White Volta, Bazua Bridge, 10 miles west of Bawku, north Ghana, 28. vi. 61, British Museum (N.H.) reg. no. 1964.9.8. 278.

DESCRIPTION based on the holotype and 15 paratypes 20–29 mm. S.L. from the White Volta, Bazua and on 17 specimens 21–26 mm. S.L. from the River Morago, Nakpanduri, 45 miles south of Bawku. Body moderately compressed. S.L. 3.1 to 4.1 times the maximum depth and 3.55 to 4.2 times the length of the head. Predorsal profile convex with a slight nuchal hump. Snout rounded 0.65 to 0.95 times the length of the head. Mouth moderate, slightly protrusible and subterminal. Anterior barbel 0.25 to 0.7 times and the posterior barbel 0.6 to 1.1 times the diameter of the eye. The tip of the anterior barbel usually extends to the vertical to the anterior margin, and the tip of the posterior barbel beyond the centre of the eye. Eye moderate 2.85 to 3.8 times in the length of the head and 1.05 to 1.4 times in the inter-

orbital width. Weakly-developed pit-lines visible on the cheeks and operculum. Pectoral fin 0.6 to 0.8 times as long as the head, the tip falling well short of the pelvic origin. The last simple dorsal ray smooth, flexible, 0.9 to 1.1 times the length of the head. Apex of dorsal fin rather pointed, distal margin concave. Dorsal fin rays III 8; anal fin rays III 5. The pelvic origin lies between the verticals to the first and second branched dorsal rays. Caudal peduncle slender, 1.45 to 2.0 times as long as deep. Scales radially striated, 24 to 28 in the lateral line row (modal number 26). Lateral line incomplete, perforated scales usually consecutive, 4 to 9 in number at the anterior end of the row. In a few individuals, however, up to 21 perforated scales were noted; the additional scales were not arranged consecutively but were scattered irregularly amongst blank scales. The lateral line row dips to a maximum depth of half a scale below the myoseptum in the anterior third of the body. There are $3\frac{1}{2}$ scales between the lateral line and the dorsal origin, $3\frac{1}{2}$ scales between the lateral line and the ventral midline immediately in front of the pelvic origin and 2 to $2\frac{1}{2}$ scales between the lateral line and the pelvic origin. Eight (f.1), 9 (f.24) or 10 (f.6) scales round the caudal peduncle.

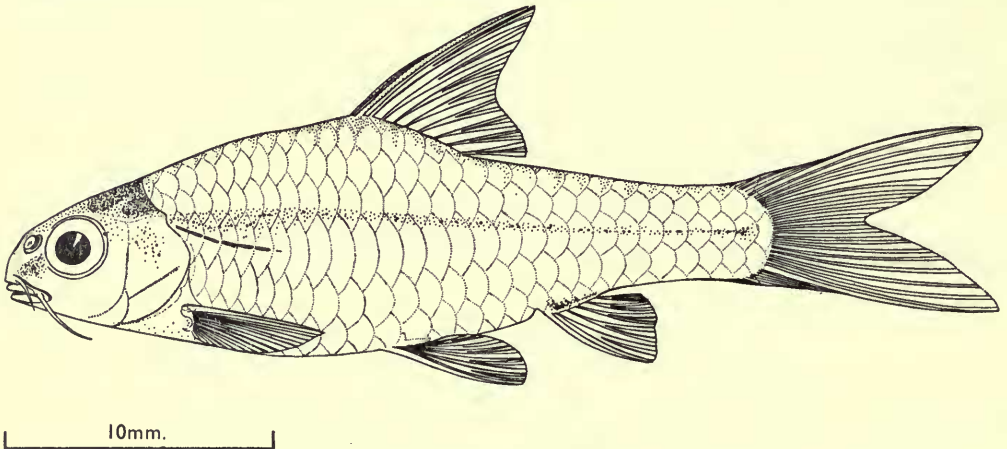


FIG. 15. *Barbus bawkuensis*.

Summary of morphometric data based on 33 fish, 20 to 29 mm. S.L.; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth	24.4-31.1	27.7	—
Length head	23.8-28.5	25.9	—
Diameter eye	7.1-9.0	7.7	—
Interorbital width	8.9-11.5	9.9	—
Length snout	5.7-6.9	6.3	—
Length anterior barbel	1.9-4.6	3.0	—
Length posterior barbel	4.4-8.0	6.1	—
Length pectoral fin	15.5-21.2	18.3	—
Length dorsal fin	22.6-28.8	25.4	—
Length caudal peduncle	19.5-22.8	21.4	—
Depth caudal peduncle	12.0-14.0	12.8	—

COLORATION : *in formalin-fixed specimens* dorsal surface with a light scattering of melanophores near the margin of each scale. A narrow, diffuse band of melanophores runs mid-laterally from the operculum to the end of the caudal peduncle. An indistinct black spot lies at the base of the anal fin. The body is otherwise pigment-free. The snout is marked laterally with a dark streak which does not extend forwards onto the tip. Dark pigment is noticeable along the anterior margin of the dorsal fin.

DIAGNOSIS AND AFFINITIES : morphometrically, *B. bawkuensis* is very similar to *B. punctitaeniatus* differing only in the shorter barbels (anterior 1.9–4.6 cf. 3.2–6.4% S.L. ; posterior 4.4–8.8 cf. 6.0–11.2% S.L.) and in the slightly higher modal number (26 cf. 25) of lateral line scales. *Barbus bawkuensis*, however, lacks the black streak on the tip of the snout and the dark spots on the lateral line scales characteristic of *B. punctitaeniatus*. Other minor differences in the newly described species are heavier pigmentation on the last simple dorsal ray and a darker spot at the base of the anal fin. *Barbus bawkuensis* and *B. punctitaeniatus* are remarkable for their high variability in the number of perforated lateral line scales. This unusual feature has been noted previously in *B. anoplus* (Groenewald, 1958) where, as in *B. bawkuensis*, the lateral line is frequently interrupted, and also in *B. pobeguini* from Ksar Torchane, Mauritania (Daget, 1954) where some specimens had complete, others rudimentary lateral lines. *Barbus bawkuensis* and *B. punctitaeniatus* are unique among West African species in the combination of a incomplete lateral line and two pairs of relatively long barbels.

DISTRIBUTION : at present known only from the White Volta and its tributaries near Bawku, northern Ghana.

Barbus pobeguini Pellegrin, 1911

(Text-fig. 16)

Barbus pobeguini Pellegrin, 1911, *Bull. Soc. zool. France*, 36 : 187.

Barbus pobeguini : Daget, 1954, *Mem. Inst. France. Afr. Noire*, no. 36 : 205, fig. 71.

DESCRIPTION based on 24 fish 29–36 mm. S.L., from Dedoro Tankara Dam, 8 miles north-east of Navrongo (Volta basin), north Ghana. Body cylindrical, only slightly compressed. S.L. 3.7 to 4.3 times the maximum depth and 3.5 to 3.8 times the length of the head. Predorsal profile smooth, convex. Snout rounded, 0.85 to 1.0 times the diameter of the eye. Mouth moderate, subterminal. The single pair of short barbels 0.1 to 0.3 times the diameter of the eye. Eyes relatively small, inclined slightly upwards, the diameter 3.45 to 4.0 times in the length of the head and 1.35 to 1.7 times in the interorbital width. Weakly-developed pit-lines present on the cheeks. Pectoral fin 0.65 to 0.8 times the length of the head, the tip falling well short of the pelvic origin. Last simple dorsal ray smooth, flexible, 0.8 to 0.9 times the length of the head. Apex of dorsal fin rounded, distal margin slightly convex. Dorsal fin rays III 7 ; anal fin rays III 5. The pelvic origin lies within the verticals to the first or second dorsal rays. Caudal peduncle 1.45 to 1.75 times as long as deep.

The lateral line dips to a maximum depth of one scale row below the horizontal myoseptum in the anterior third of the body; the two converge in the first third of the caudal peduncle. Twenty-seven to 32 lateral line scales (modal number 29). Four and a half to $5\frac{1}{2}$ scales between the lateral line and the dorsal origin, $5\frac{1}{2}$ scales between the lateral line and the mid-ventral line immediately in front of the pelvic origin and $2\frac{1}{2}$ to 3 scales between the lateral line and the pelvic origin. Twelve (f.21) or 13 (f.3) scales round the caudal peduncle.

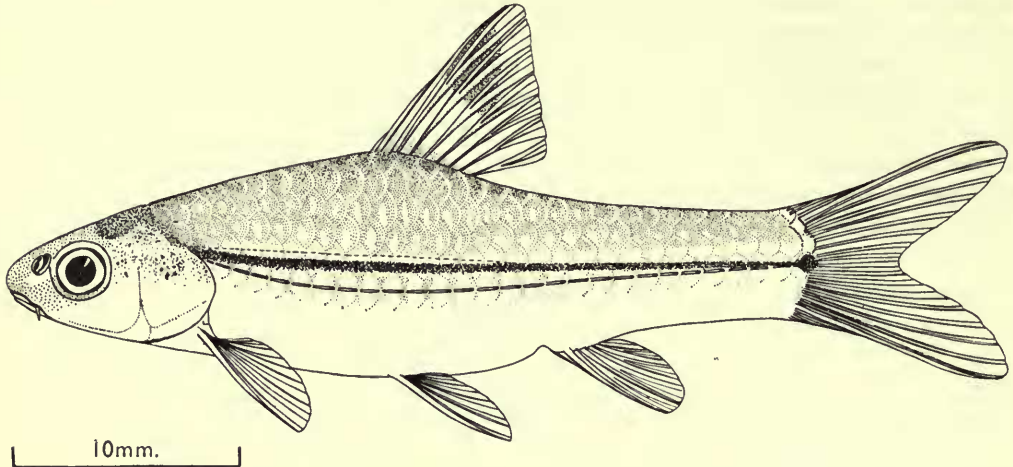


FIG. 16. *Barbus pobeguini*.

Summary of morphometric data based on 24 fish, 29 to 36 mm. S.L.; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth	23.5-26.5	24.2	—
Length head	26.2-28.0	27.1	—
Diameter eye	6.8-8.7	7.2	—
Interorbital width	10.0-11.5	10.5	—
Length snout	6.3-7.2	6.8	—
Length barbel	0.7-2.2	1.4	Positive
Length pectoral fin	17.6-22.0	19.6	Negative
Length dorsal fin	21.5-25.5	23.4	—
Length caudal peduncle	21.8-24.1	22.7	—
Depth caudal peduncle	12.9-15.2	13.9	—

COLORATION: in *living specimens* silvery with a characteristic steel-blue iridescence. A dark lateral band ends in a small but pronounced spot on the caudal peduncle. There is an oblique black stripe on the distal half of the anterior rays of the dorsal fin. In *formalin-fixed specimens* dorsal surface well peppered with melanophores absent from a narrow zone close to the margin and thinning out towards the centre of each scale. Dark pigment fades out on the flanks, and scales below the lateral line are clear. Pockets of anterior lateral line scales each with a small black streak

divided horizontally into two by the lateral line pore. The upper halves of the streaks persist on more posterior scales. A narrow black lateral band slightly below the myoseptum extends backwards onto the caudal peduncle, stopping just short of a round black spot on the tip. The spot overlaps the base of the caudal rays. Dorsal fin with a narrow black stripe, parallel with the distal margin of the fin, on the upper halves of the last simple and first three branched rays.

DIAGNOSIS: these data are in close agreement with descriptions of *B. pobeguini* from the Middle Niger (Pellegrin, 1911 and Daget, 1954). *Barbus pobeguini* appears to have no close relatives in West Africa. The presence of a single pair of barbels, 7 branched dorsal rays and the distinctive colour pattern should prevent confusion with other species in the area. Pellegrin (*op. cit.*) has pointed out the similarity of this species with *B. afer* Peters from South Africa.

HABITAT AND DISTRIBUTION: in Ghana, rivers, streams and pools throughout the northern regions. The commonest *Barbus* in flood water; often found in temporary streams after storms and one of the first colonizers of newly built dams. Never abundant in the larger rivers. Elsewhere, basins of the Niger (Daget, 1954) and Comoé (Blanc & Daget, 1957) and in Mauretania (Daget, 1954).

LIFE HISTORY: *Barbus pobeguini* apparently breeds during the rains. Ripening fish were observed in June and juvenile stages appeared in August. Growth is more rapid in females than in males. Maximum size, a female 50 mm. S.L.

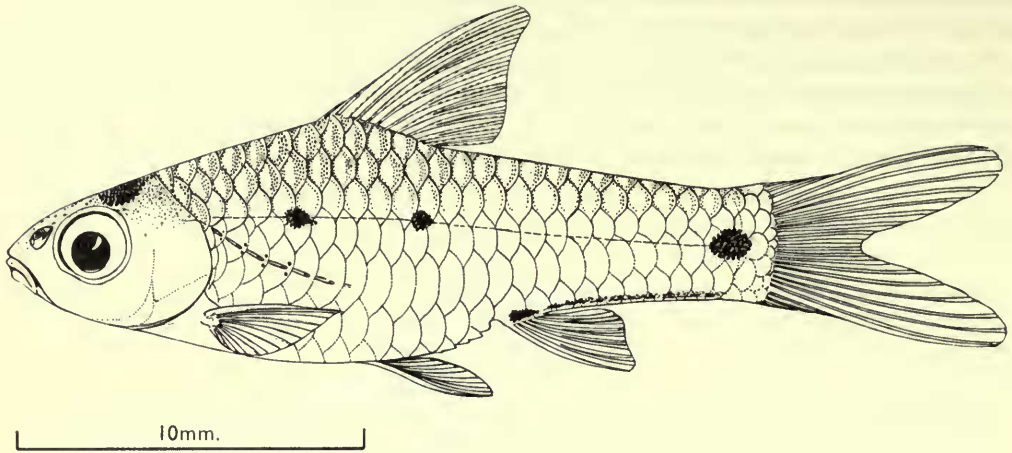
Barbus stigmatopygus Boulenger, 1903

(Text-fig. 17)

Barbus stigmatopygus Boulenger, 1903, *Ann. Mag. nat. Hist.* (7) 12: 533; *Idem*, 1911, *Cat. Afr. Fish.* 2: 185, fig. 163.

Barbus stigmatopygus: Daget, 1954, *Mem. Inst. France. Afr. Noire*, no. 36: 210, fig. 75.

DESCRIPTION based on 24 fish, 16–19 mm. S.L. from the Black Volta, 3 miles west of Lawra, northern Ghana. Body compressed. S.L. 3.2 to 3.8 times the maximum depth and 3.45 to 3.95 times the length of the head. Predorsal profile convex. Snout short, bluntly pointed, 0.55 to 0.75 times in the diameter of the eye. Mouth terminal, small. Eyes lateral, relatively large, 2.45 to 2.8 times in the length of the head and 0.95 to 1.15 times in the interorbital width. A few weakly-developed pit-lines present on the cheek and operculum. Barbels absent. Pectoral fin 0.6 to 0.75 times as long as the head, its tip falling short of the pelvic origin. Last simple ray of dorsal fin smooth, flexible, 0.8 to 1.0 times the length of the head. Apex of dorsal fin rounded, distal margin concave. Dorsal fin rays III 8. Anal fin rays III 5. Origin of pelvic fin between the verticals to the last simple and first branched dorsal rays. Caudal peduncle 1.25 to 1.5 times as long as deep. Lateral line incomplete, only the first 4 to 7 scales in the row perforated. There are 23 to 25 (modal number 24) scales in the lateral line row, $4\frac{1}{2}$ scales between the lateral line and the dorsal origin, $2\frac{1}{2}$ scales between the lateral line and the mid-ventral line immediately in front of the pelvic origin and $1\frac{1}{2}$ scales between the lateral line and the pelvic origin. Nine (f.1) or 10 (f.23) scales round the caudal peduncle.

FIG. 17. *Barbus stigmatopygus*.

Summary of morphometric data based on 24 fish, 16 to 19 mm. S.L. ; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth	26.1-31.2	28.5	—
Length head	25.2-28.9	27.3	—
Diameter eye	9.5-11.2	10.3	—
Interorbital width	10.3-11.9	11.1	—
Length snout	5.8-7.4	6.7	—
Length pectoral fin	16.8-20.0	18.6	—
Length dorsal fin	22.1-27.6	24.9	—
Length caudal peduncle	17.6-21.2	19.9	—
Depth caudal peduncle	13.2-15.0	14.2	—

COLORATION: *in living specimens* dorsal surface finely patterned with yellow and black chromatophores, scales of the lateral line and below, silvery. A round black terminal spot on the caudal peduncle and a second spot at the base of the anal fin are always present. Two additional spots frequently occur on the horizontal myoseptum in the anterior half of the body. The fins are colourless. There is a yellow arc over the pupil of the eye. Specimens from clear water are frequently transparent with the vertebral column and viscera visible through the body wall. *In formalin-fixed specimens* the scales of the dorsal surface are outlined with a fine lacework of melanophores which fade away on the flanks. A small round black spot at the tip of the caudal peduncle is always present, as is a compact group of melanophores at the base of the anal fin, which continues backwards as a thin black line along the ventral surface of the caudal peduncle. Two further round black spots, smaller than the one on the caudal peduncle, usually occur on the horizontal myoseptum, the first at the level of the fifth lateral line scale, the second below the last ray of the dorsal fin. One or both of these may be absent. Pockets of anterior lateral line scales are frequently marked with a black dot above and below the canal.

DIAGNOSIS: these data correspond closely with previous descriptions of *B. stigmatopygus*. Despite careful examination of the material described here we can find no trace of the single pair of much reduced barbels which Dr. Trewavas recently observed in specimens from the White Nile and Lake No (*pers. com.*). *Barbus stigmatopygus* is easily distinguished by its markings from other small *Barbus* with similarly reduced lateral lines and barbels.

HABITAT AND DISTRIBUTION: *in Ghana*, judging from our records, *B. stigmatopygus* is a relatively rare and local species. With the exception of two fish from the River Nasia near Tamale all records are from backwaters and tributaries of the Black Volta in the Lawra district where it is not uncommon. The habitat is always deep, relatively still water, free from vegetation. *Elsewhere*, widespread in the Sudanese belt. Recorded from the White Nile (type locality), the Middle Niger (Daget, 1954), Haute Volta (Blanc & Daget, 1957) and the Geba River, Portuguese Guinea (Boulenger, 1911).

Barbus leonensis Boulenger, 1915

(Text-fig. 18)

Barbus leonensis Boulenger, 1915, *Ann. Mag. nat. Hist.* (8) 15 : 203 ; *Idem*, 1916, *Cat. Afr. Fish.* 4 : 273, fig. 167.

Barbus leonensis : Daget, 1954, *Mem. Inst. France. Afr. Noire*, no. 36 : 209, fig. 74.

DESCRIPTION based on 24 fish 27 to 33 mm. S.L. from the water-works reservoir, Tamale, north Ghana (Volta basin). Body somewhat compressed. S.L. 3.1 to 3.7 times the maximum depth and 3.2 to 3.7 times the length of the head. Predorsal profile smooth, convex. Snout pointed, 0.7 to 0.95 times the diameter of the eye. Mouth small, slightly subterminal. Eyes lateral, 2.9 to 3.35 times in the length of

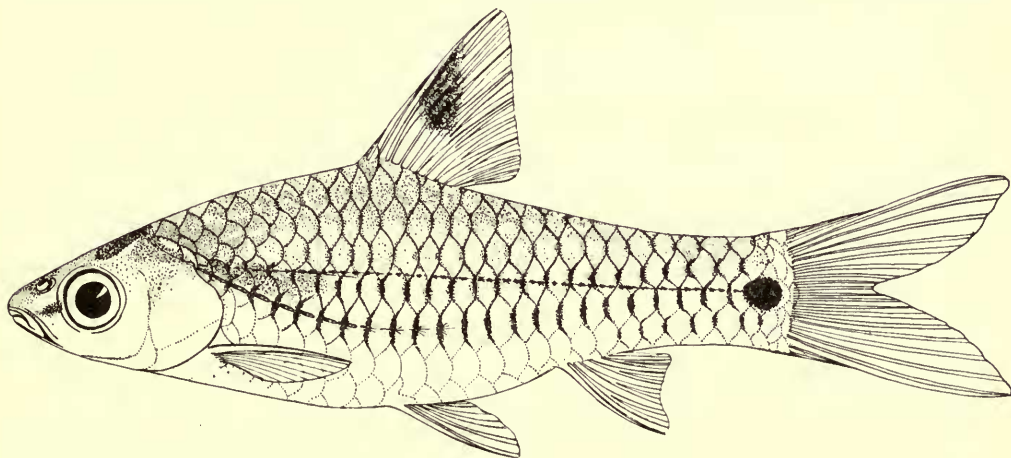


FIG. 18. *Barbus leonensis*.

the head and 1.15 to 1.4 times in the interorbital width. Barbels absent. A few weakly-developed pit-lines on the cheeks and on the operculum. Pectoral fin 0.55 to 0.7 times the length of the head, the tip falling short of the pelvic origin. The last simple dorsal ray is smooth, flexible, 0.75 to 0.95 times as long as the head. Apex of the dorsal fin slightly rounded, the distal margin straight. Dorsal fin rays III 7 (f.2) or III 8 (f.22). Anal fin rays III 5 (f.21) or 6 (f.3). The origin of the pelvic fin lies between the verticals to the first and second dorsal rays. Caudal peduncle 1.2 to 1.5 times as long as deep. The lateral line is always incomplete; 6 to 10 anterior scales are perforated. There are 22 to 26 scales (modal number 24) in the lateral line scale row, $4\frac{1}{2}$ to $5\frac{1}{2}$ scales between the lateral line and the dorsal origin, $2\frac{1}{3}$ scales between the lateral line row and the mid-ventral line immediately in front of the pelvic origin, and $1\frac{1}{2}$ scales between the lateral line and the pelvic origin. Eight (f.1), 9 (f.18) or 10 (f.5) scales round the caudal peduncle.

Summary of morphometric data based on 24 fish, 27 to 33 mm. S.L.; measurements are expressed as percentages of S.L.

	Range	Mean	Allometry
Maximum depth	27.0-31.8	29.3	—
Length head	27.5-30.3	28.6	—
Diameter eye	8.2-9.6	8.9	—
Interorbital width	10.4-12.8	11.5	—
Length snout	6.6-8.2	7.3	—
Length pectoral fin	16.6-21.0	18.6	—
Length dorsal fin	23.0-26.0	23.8	—
Length caudal peduncle.	18.2-21.0	19.6	—
Depth caudal peduncle	13.1-15.4	14.3	—

COLORATION: *living specimens* pale lemon yellow in colour with two rounded black spots, one on the caudal peduncle the other on the anterior rays of the dorsal fin. Yellow pigment brightest in an arc over the pupil of the eye and in the vicinity of the two black spots. *Living specimens* frequently transparent, the vertebral column and viscera clearly visible through the body wall. *In formalin-fixed specimens* dorsal surface with an even scattering of melanophores thinning out and disappearing on the flanks. Scales of the lateral line row and above lightly outlined with melanophores which are thicker in a vertical line on the pocket of each scale, thus forming a regular pattern over the dorsal surface of the fish. Traces of the pattern may persist on the row below the lateral line but the ventral surface is generally pigment-free. The black spot on the caudal peduncle is equal in diameter to the depth of one scale row and slightly overlaps the base of the caudal fin. The side of the snout is marked with a narrow, horizontal, band of melanophores touching the anterior margin of the eye. The spot on the dorsal fin lies between the last simple and the third branched ray at a point midway between the base and the apex of the fin.

DIAGNOSIS: these data correspond closely with the description of the types from Sierra Leone and also with data obtained by Daget (1954) from fish in the Middle Niger. We, however, record 9 as the modal number of scales round the caudal peduncle compared with 8 in the previous descriptions. *Barbus leonensis* is easily

distinguished from *B. anema* and *B. stigmatopygus* (both of which have incomplete lateral lines and no barbels) by the characteristic pattern of pigmentation.

HABITAT AND DISTRIBUTION: *in Ghana*, widespread in well-vegetated pools, oxbow lakes and dams throughout northern Ghana. Rare in rivers and streams. *Elsewhere*, recorded from much of the savannah zone of West Africa—Sierra Leone (type locality), Gambia River (Johnels, 1954), Niger basin (Daget, 1954), Comoé (Blanc & Daget, 1957), Haute Volta (Blanc & Daget, *op. cit.*) and Chad (Daget, *op. cit.*).

LIFE HISTORY: spawning is confined to the rainy season, June to September. All fish mature at the age of 8 to 10 months. Few individuals, if any, survive their first spawning season and the maximum life span is probably 15 months. Growth is slightly more rapid in females than in males. Maximum size, 33 mm. standard length.

KEY TO THE VOLTAIC SPECIES OF *Barbus*

- 1 Well-developed pit-lines present; individual pits bead-like in appearance, forming parallel ridges on the side of the snout, the cheek, the operculum and on the dorsal surface of the head between the eyes subgenus ***Beirabarus*** 2
- Cephalic pits relatively few in number, sometimes orientated into lines, but with the individual pits well-separated from one another and usually visible only on the cheek and on the operculum 3
- 2 Apex and second simple ray of dorsal fin dense black; heavy melanophores form a conspicuous mid-lateral band running from the side of the snout to the tip of the caudal peduncle; pockets of lateral line scales with relatively broad, triangular spots; 12 scales round the caudal peduncle; the tip of the pectoral fin never overlaps the pelvic origin; snout 6.3–7.3% S.L.; caudal fin in living specimens orange-red ***B. macrops***
- No dense pigment patches on the dorsal fin; mid-lateral band relatively light; pockets of lateral line scales with narrow and crescentic vertical stripes; usually 10 or 11 scales round the caudal peduncle; the tip of the pectoral fin often overlaps the pelvic origin; snout 6.4–7.6% S.L.; caudal fin pale pink in living specimens ***B. parablabe***
- No dense black pigment patches on the dorsal fin; mid-lateral band faint; pockets of lateral line scales with relatively narrow vertical bars of pigment; 12 scales round the caudal peduncle; the tip of the pectoral fin sometimes overlaps the pelvic origin; snout 7.8–8.8% S.L. ***B. spurrelli***
- 3 Lateral line scales markedly deep, over 2.7 times as deep as long; dorsolateral scales outlined with melanophores which are concentrated in a vertical arc on the pocket of each scale; mid-lateral band, if present, very faint; an oblique black stripe often lies between the origin of the lateral line and the base of the pectoral fin: subgenus *Clypeobarbus* ***B. hypsolepis***
- Lateral line scales not markedly deep, under 2.4 times as deep as long; pigment pattern consisting of lateral stripes or spots; no black stripe between the origin of the lateral line and the base of the pectoral fin 4
- 4 Barbels present 5
- Barbels absent 13
- 5 Usually 8 branched dorsal rays 6
- Usually 7 branched dorsal rays 12

- 6 Body marked with three or more mid-lateral spots ; one in the anterior third of the body, one below the last dorsal ray and one on the caudal peduncle are nearly always present ; the spots are sometimes partly obscured by a dark mid-lateral band 7
 Body marked with a black mid-lateral band, sometimes broken into irregular spots or streaks 9
- 7 Body marked with three mid-lateral spots 8
 Body marked mid-laterally with four or more large rounded black spots *B. sublineatus*
- 8 Dorsolateral surface with two or three dark longitudinal stripes ; barbels relatively long, the anterior clearly overlapping the base of the posterior ; mouth not protrusible obliquely downwards ; spot at the base of the anal fin relatively faint *B. macinensis*
 Dorsolateral surface without longitudinal stripes ; barbels short, the anterior barely overlapping the base of the posterior ; mouth small, protrusible obliquely downwards ; black spot at the base of the anal fin conspicuous *B. voltae*
- 9 Lateral line complete ; $4\frac{1}{2}$ or $5\frac{1}{2}$ scales between the lateral line and the dorsal origin 10
 Lateral line usually incomplete ; $3\frac{1}{2}$ scales between the lateral line and the dorsal origin 11
- 10 Mid-lateral band more or less continuous from the tip of the operculum to the end of the caudal peduncle ; mouth large, barbels long, the posterior extending to or beyond the posterior margin of the eye *B. nigriensis*
 Mid-lateral band, originating between the operculum and the dorsal fin, frequently broken into irregular spots or streaks ; mouth moderate in size ; barbels moderate, the posterior not extending past the vertical to the posterior margin of the pupil *B. lawrae*
- 11 Black pigment on the snout continuous round the tip from eye to eye ; conspicuous black spots on the scale pockets of the lateral line *B. punctitaeniatus*
 Black pigment on the snout confined to the sides ; scale pocket pigment of the lateral line inconspicuous *B. bawkuensis*
- 12 Two pairs of barbels ; mid-lateral pigmentation variable but three spots often present ; no spot on the dorsal fin *B. atakorensis*
 One pair of barbels ; a narrow continuous mid-lateral band ends in a spot on the tip of the caudal peduncle ; dorsal fin marked with a black streak across the distal half of the anterior rays *B. pobeguini*
- 13 Dorsal fin marked with a round black spot ; body with a single spot on the tip of the caudal peduncle *B. leonensis*
 No spot on the dorsal fin ; Body marked with two to four black spots, one at the base of the anal fin, the others on the horizontal myoseptum *B. stigmatopygus*

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